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JERUSALEM BAGHDAD

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Fig. 1. Roman Reservoir at Umm ej-Jemâl (photo Palestine Archaeological Museum).

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FORTY-SECOND ANNUAL REPORT OF THE PRESIDENT

To the Trustees of the Schools.

GENTLEMEN:

On the whole our work has proceeded this year much as it did the year before. The field work of the Baghdad School cannot yet be resumed. The continuation and virtual completion of the Transjordan survey has therefore been our only active archaeological enterprise, but that is quite sufficient to justify our existence. The cooperation of the Smithsonian Institution in the Transjordan survey calls again for grateful acknowledgment. It is no vain repetition to say once more that we have been extraordinarily fortunate during these difficult years in having Dr. Glueck's services as Director of the Jerusalem School. The watchful interest of our Consul General and his staff has this year as always been very helpful, particularly when Dr. Glueck has been away from Jerusalem.

Under the present circumstances publication has been our major activity. After much unavoidable delay, volume XXIII of the *Annual*, containing Dr. Kramer's edition of Sumerian texts, may be expected from the press very soon. That the *Bulletin* and the *Biblical Archaeologist* are performing their function to the satisfaction of all is shown by their subscription lists, which have not been reduced by wartime conditions. Miss Porada's manuscript and photographs of Nuzi seal impressions are nearly ready for publication, and the two volumes of the Tell en-Naṣbeh expedition, in the publication of which we are cooperating with the Palestine Institute of the Pacific School of Religion, are in press. Arrangements have been made with the American Oriental Society for the joint publication of the volume of mathematical cuneiform texts edited by Doctors Neugebauer and Sachs. The original edition of Dr. Glueck's book, *The Other Side of the Jordan*, is about exhausted, and since the demand for it continues, augmented by urgent requests from Palestine, we are having a lithoprinted reproduction made. Orders for our publications are now coming again from abroad, and European scholars evince a moving eagerness to renew their contacts with our work.

Since the beginning of the year our corporate membership has had one accession, the Los Angeles Baptist Theological Seminary. There are no defections to report. Our individual members stand by us, and new Associate Members are being enrolled frequently.

The healthy condition of our organization has been shown during the year in two ways. The large attendance at our Board meeting in May, after untoward circumstances had prevented a full meeting in December, was one indication. At that meeting we were able to welcome a new trustee, Dr. Wetmore, and a new Associate Trustee, Dr. Arbez. Others, who were already members of the Board but had been unable to attend meetings previously, were with us also. The second special sign of health was the formation of a joint committee of the Board and the Corporation

for further study of our program and policies, based on the important report presented last December by Professor Kraeling.

Our financial condition is stronger than it has ever been. During the year Mr. Newell's bequest has been received. Our present policy, aside from publication, is one of husbanding our resources for the anticipated demands of the post-war era, when opportunities will be greater than ever before.

Respectfully submitted,

MILLAR BURROWS,
President.

New Haven, December 1, 1944.

REPORT OF THE DIRECTOR OF THE SCHOOL IN JERUSALEM

To the President and Trustees of the American Schools of Oriental Research:

I have the honor to submit the following report of the School in Jerusalem for the academic year which closed June 30, 1944.

The war is receding farther and farther from Palestine. Soon, we hope, the central festering sore of Nazi Germany will be cut out and the basis for the restoration of world health be reestablished. The impact of war conditions continues to be felt in highly inflated prices. Food supplies have had to be stretched to go around. The controls over food and general supplies instituted by the government have been fairly effective.

The School has been able to continue its scientific field work through the further archaeological exploration of Transjordan. The Director was aided in this by a renewed grant from a special fund at the disposal of the Smithsonian Institution. During this year, the School's expedition has explored archaeologically the northernmost and easternmost stretches of Transjordan. They include the area north of the Iraq Oil Co. pipeline as far as the Syrian border, and the entire Transjordan side of the Wâdī Sirḥân, which separates most of the eastern boundary of Transjordan from Saudi Arabia. It has proven impossible thus far to get into the Saudi Arabian part of the Wâdī Sirḥân. The School's archaeological survey of Transjordan has now been carried northward from the Gulf of 'Aqabah to the Syrian border, and eastward from the line of the Jordan Valley and the Wâdī 'Arabah to the Wâdī Sirḥân. There are some, but not important, lacunae in the survey. At least 80 per cent, and probably more, of all ancient historical sites in Transjordan have been carefully examined, so far as surface remains are concerned. Preparations for the publication of the fourth and final volume of *Explorations in Eastern Palestine* as an *Annual* of the Schools are well under way. Over a hundred full plates of pottery alone will be included. The manuscript of a new book, *The Jordan*, is ready for publication. The Director has published the following articles during the year: "Some Ancient Towns in the Plains of Moab," BULLETIN 91, pp. 7-26; "Ramoth-gilead," BULLETIN 92, pp. 10-16; "The Jordan," *The Biblical Archaeologist*, December 1943,

pp. 62-67; "On the Trail of King Solomon's Copper Mines," *The National Geographic Magazine*, February 1944, pp. 233-256.

The library of the School has been much used during the year by various scholars. It has been extremely difficult to get books and magazines for it. After the war, there will be many gaps to fill.

The Director flew home in August, 1943, and started back by boat in January, 1944. On his return, he found that Mrs. Inna Pommerantz, the Secretary-Business Manager of the School, had carried on efficiently during his absence. She has since then too discharged her duties competently. She and her husband, who is a civil engineer employed by the Jerusalem Municipality, and their small son, continue to live in a wing of the Annual Professor's apartment at the School. The Hostel has been well patronized during the year. The buildings and grounds are in good shape. The School is a lovely place to live and work in. The servant staff, headed by Shukri Audeh, has, on the whole, measured up to the needs of the institution. Even in Jerusalem, there are servant problems. Lady Petrie and Dr. Aage Schmidt continue to reside permanently at the School. It will be a grand day when our annual professors and graduate students can once again come out from America, and normal academic work can be resumed, in addition to the archaeological field work that has been conducted almost uninterruptedly by the School despite the war.

To el-Farik, Lt. Col. J. B. Glubb, Officer Commanding the Arab Legion, and to his assistant, Broadhurst Bey, many thanks are due for much assistance in carrying out the archaeological survey of the west side of the Wâdī Sirḥân. Glubb Pasha sent along an army truck, with a complement of an officer, Said Bey, seven soldiers, and a competent guide. As usual, Mr. A. S. Kirkbride, British Resident in Transjordan, and Mr. Lankester Harding, Chief Curator of Antiquities there, have lent all manner of assistance. To Mr. and Mrs. A. S. Kirkbride I am gratefully indebted for their hospitality in Amman. Mr. Robert Hamilton, Director of the Department of Antiquities in Palestine, and members of his staff, have continued to do everything possible to assist the work of the School. Rashid Hamid of the Transjordan Department of Antiquities again accompanied me on several trips. I salute the hospitable Arabs, too numerous to mention, encountered along the highways and byways of Transjordan, without whose friendly help archaeological work there would be impossible. It is a great privilege to be able to work in the Holy Land.

NELSON GLUECK,
Director.

Jerusalem, July 1, 1944.

THE ANNUAL FINANCIAL REPORT
OF
THE AMERICAN SCHOOLS OF ORIENTAL RESEARCH

CONDENSED CASH STATEMENT FOR FISCAL YEAR ENDING JUNE 30, 1944

Income Received

Contributions for Maintenance			$ 273.86
Corporation Dues			5,025.00
Sale of Books			1,000.00
Income from Investments—			
General Endowment Fund		$13,424.50	
Jastrow Memorial Fund		52.78	
John P. Peters Memorial Fund		19.72	
Schofield Fund		12.45	
Warburg Reserve Fund		312.50	
			13,821.95
Received from J. B. Nies Estate—			
For Publications		$ 109.96	
To be reserved for work of the Bagdad School		11,413.53	
			11,523.49
			$31,644.30

Expenditures

Administration			
Salaries	$ 1,270.00		
Assistant Treasurer's fee	1,650.00		
Audit fee	50.00		
Small sundry costs	89.46		
		$ 3,059.46	
The Annual			
650 copies Volumes 21-22	$ 2,464.17		
Additional costs	90.00		
		2,554.17	
The Bulletin			
1300 copies Nos. 91, 92, 93, 94		810.33	
Bagdad School Account			
Salaries		720.00	
Jerusalem School Account			
Salary of Director	$ 5,000.00		
Advanced for Maintenance	2,000.00		
Books Bought	171.08		
		7,171.08	
Publication Account			
Bindery, etc. re Glueck Volume— "Other Side of Jordan"	$ 54.81		
1500 copies Burrows Volume— "What Mean These Stones"	955.32	1,010.13	

Appropriation for Transjordan survey		3,000.00	
Former advance to Summer Institute		500.00	
Withdrawn for transfer to—			
Reserve for Research	15,000.00		
Addition to Nies Reserve Fund for work of Bagdad School	15,500.00	30,500.00	49,325.17
Reduction in General Corporate Account for year 1943–1944			$17,680.87

FINANCIAL STATEMENT AS OF JUNE 30, 1944

Assets

Cash		
Subject to Check	$22,509.57	
Awaiting Investment	35,650.11	
Held in Reserve Account	6,164.81	
		$ 64,324.49
Investments		366,939.14
Furnishings and Equipment		4,601.46
Buildings		69,432.00
Real Estate in Jerusalem		27,181.93
		$532,479.02

Liabilities

Due Collector of Internal Revenue for Taxes Withheld		$ 33.80
Principal of Endowment Funds		
General	$312,554.27	
Jastrow Memorial	1,279.77	
Helen W. Moulton Memorial	5,000.00	
Edward T. Newell Fund	5,000.00	
John P. Peters Memorial	533.16	
Edward Robinson Fund	18,722.05	
Schofield Fund	500.00	
Anne E. Stodder Fund	3,500.00	
		347,089.25
Principal of Nies Building Fund		52,666.63
Reserve Funds		
For Research	$15,000.00	
For Work of Bagdad School (J. B. Nies Estate)	19,164.81	
For Maintenance (Warburg Fund)	27,500.00	
		61,664.81
General Corporate Account		71,024.53
		$532,479.02

"We have examined the records and securities of the American Schools of Oriental Research for the fiscal year ended June 30, 1944, and, in our opinion, the above statements reflect the transactions for the year, and the financial condition of this institution at June 30, 1944."

WHEELER, CROSBIE & COMPANY,
Certified Public Accountants,
Lincoln-Liberty Bldg., Philadelphia, Pa.

LIST OF GIFTS TO THE LIBRARY

(July 1st, 1943–June 30th, 1944)

Author	*Title*	*Presented by*
Albright, W. F.	AASOR Vol. XXI-XXII, 2 copies	ASOR
Glueck, Nelson	"On the Trail of King Solomon's Mines," *Nat. Geograph. Mag.* Feb. 1944	author
Glueck, Nelson	"The Excavation of Solomon's Seaport of Ezion-geber," *Annual Report Smithsonian Inst*	"
Goitein, S. D. F.	*The Origin of the Vizirate*	"
Melamed, E. Z.	"The Onomastikon of Eusebius," (Hebrew), *Tarbiz*, III-IV	"
Stephan, St. H.	"An Endowment Deed of Khasseki Sultan," QDAP, X	"

List of Exchanges

Ewald, Heinrich	*Die poetischen Bücher des alten Bundes, Dritter Teil–Iob*	exchanged with Ecole Biblique
Lidzbarski, M.	*De propheticis legendis Arabicis*	" "

List of Purchases

'Aref el-'Aref	*Bedouin Lore, Law and Legend*	Jerusalem, 1944
Arnold and Guillaume, eds.	*The Legacy of Islam*	London, 1943
Ben-Yehuda, E.	*Thesaurus*, Vol. X	Jerusalem, 1944
Blake, G. S.	*The Stratigraphy of Palestine and its Building Stones*	Jerusalem
Dalman, Gustaf	*Sacred Sites and Ways*	London, 1935
Grant, C. P.	*The Syrian Desert*	London, 1937
Ingrams, Harold	*Arabia and the Isles*	London, 1942
Lammens, H.	*L'Islam*, 2nd ed	Beirut, 1941
Konikoff, A.	*Transjordan, an economic survey*	Jerusalem, 1943
Melamed, E. Z.	*Halachic Midrashim of the Tannaim in the Talmud*, I (Hebrew)	Jerusalem, 1943
Morton, H. V.	*In the Steps of St. Paul*	London, 1936
Morton, H. V.	*In the Steps of the Master*	London, 1943
Nicholson, R. A.	*A Literary History of the Arabs*	Cambridge, 1941
Pal. Arch. Museum	*Gallery Book, Stone and Bronze Ages.*	Jerusalem, 1937
Picard, Leo	*Structure and Evolution of Palestine.*	Jerusalem, 1943
Rostovtzeff, M.	*Dura-Europos and its Art*	Oxford, 1938
Thomas, Bertram	*Alarms and Excursions in Arabia*	London, 1931

WÂDĪ SIRḤÂN IN NORTH ARABIA

NELSON GLUECK

In a previous article on "Nabataean Syria" in the BULLETIN,[1] I suggested that the connecting life-line between the two widely separated parts of the Nabataean kingdom was the Wâdī Sirḥân. I ventured the

[1] BULLETIN 85, pp. 3-8.

doubtful hope[2] that clearly recognizable Nabataean pottery might be found there, even though none had been discovered in the northern part of the Nabataean kingdom in Ḥaurân and Jebel Drûz. I had already then come to the conclusion

> that Nabataean Syria is not to be compared with Nabataean Transjordan. It would appear then that while the Nabataeans dominated southern Ḥaurân and Jebel Drûz . . . they were not settled there in numbers large enough to warrant the production of their own distinctive type of pottery. This is in sharp distinction to southern Transjordan, where the Nabataeans settled on every available acre of cultivable soil and overflowed into adjacent marginal lands.[3]

Fig. 2. Deir el-Kahf (photo Nelson Glueck).

Further archaeological explorations by the joint expedition of the American School of Oriental Research in Jerusalem, and the Smithsonian Institution in Washington have helped to underscore the importance of the Wâdī Sirḥân for the Nabataean kingdom, and have emphasized the general absence of clear-cut Nabataean pottery outside of the southern part of the Nabataean kingdom. The phenomenon of its limitation to southern Transjordan is merely accentuated by the very fact that it is infrequent elsewhere, even in central Transjordan.[4] Thus the discovery of two fine painted bowls — the only two ever found complete and in place — in a tomb at 'Ammân recently, in no way disproves this general statement with regard to the location and distribution of Nabataean pottery.

Besides once again reexamining Umm ej-Jemâl (Fig. 1 on p. 1) this year, the School's expedition has visited practically all of the other

[2] BULLETIN 84, p. 4. [3] BULLETIN 85, p. 7. [4] BULLETIN 85, p. 3.

ancient ruined sites situated between the Iraq Oil Company pipe-line and the Syrian border. Among them may be mentioned such places as Ba'eij, Sabkhah, Sabkhîyeh, Dafyâneh, Deir el-Kahf (Fig. 2), Umm el-Qeṭein, and Burqa'ah. They are all of the same pattern as Umm ej-Jemâl, though not as well preserved nor, with the possible exception of Umm el-Qeṭein, as large. They are composed of ruined basalt buildings, many of them of imposing dimensions, occupied particularly in Roman and Byzantine but also in mediaeval Arabic times. In each of these places there is at least one and there are frequently two or more large reservoirs,

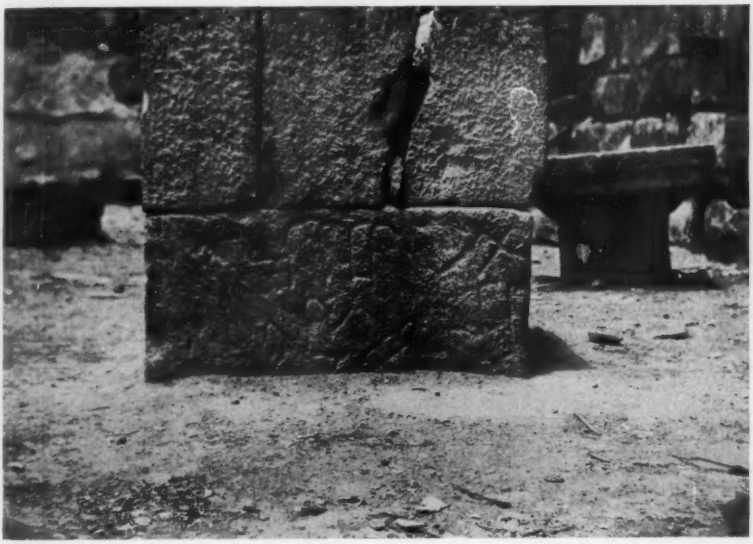

Fig. 3. Nabataean Inscription at Sabkhah, on a basalt block reused upside down in a pedestal (photo Nelson Glueck).

hewn out of the solid rock and made water-tight with facings of hewn stone covered with an additional facing of small stones tightly cemented together. In addition, almost every house had a large square or rectangular covered cistern, looking more like a reservoir than a cistern. The stone roof was supported by arches resting on pillars. The water from the winter and spring rains, which fall briefly but often fiercely in this region, was thus caught, led through covered channels into settling basins and thence into the cisterns or reservoirs; it furnished the only water-supply available for the entire year. It sufficed for the needs of a population that must have been counted by the thousands in contrast to the few hundreds that live in or around these sites today.

The inhabitants of these sites raised large flocks of sheep, goats and camels, and they also engaged in extensive dry farming. To this day, a certain amount of dry farming is carried on in this region, despite its

inhospitable appearance, with wide stretches black with large and small pieces of lava. The ancient settlements were sustained in considerable part by the trade which flowed between Syria and Transjordan and between Palestine and Arabia, but that was not enough to keep all of them, or any of them alone, for that matter. By the full exploitation of all the possibilities of soil and water as well as of trade, these communities were able to survive and even flourish for about five hundred years.

All of this area north of the pipe-line was once under Nabataean domination. Historically and geographically it belongs to the northernmost extension of the Nabataean kingdom. Indications of Nabataean settlement and influence at Umm ej-Jemâl, for instance, are too well known to be repeated here. What was true of Umm ej-Jemâl in this connection, applies also to other sites in this section. At Sabkhah, in the courtyard of a modern house constructed out of ancient building blocks, we discovered a much worn Nabataean inscription incised on a basalt stone, built upside down into a pedestal (Fig. 3). The first line of the inscription, as deciphered by Père M. R. Savignac, to whom I gave a photograph of it, seems to read *wq'mṭn (l) t*. He writes me: "Il est assez difficile de donner un sens précis à ces lettres. Le *mim* n'a pas la forme finale; mais il ne l'a pas toujours nécessairement à la fin des mots. Le signe lu *l* ou *n* pourrait, à la rigueur, être un *b* (*ṭbt*)." The second line of the damaged inscription seems to read "in the year 14".

As at Umm ej-Jemâl, the occupation of Sabkhah and related sites, to judge alone from the large quantities of sherds found at them, was heaviest in Roman and Byzantine times, although they were inhabited, as noted above, also in mediaeval Arabic times. At none of these sites, repeating the experience at Umm ej-Jemâl, could I locate on the surface a single sherd which I should unhesitatingly have designated as Nabataean. As obvious as it is that the Nabataeans were once the masters of this region and of these cities, where they lived and died as an important if not numerically superior part of the general population, it is nevertheless true that they did not bring their Nabataean pottery with them, nor did they manufacture it on the spot. They used the regionally produced Roman pottery which was contemporary with the native Nabataean wares manufactured in southern Transjordan. This Roman type of pottery, together with forms of sigillata, was produced at various centers throughout the entire ancient Near East, and sherds found at Umm ej-Jemâl or Umm el-Qeṭein were the same, for instance, as those which have been excavated at Jerash, or which can be found at hundreds of other places in non-Nabataean Transjordan. I have not yet been able to examine such sites in Syria as Sî' and Suweidā, where Nabataeans worshipped their gods in specially dedicated temples, but I doubt now whether even there much or indeed any characteristic Nabataean ware will be found. I now believe that it is possible in the light of the examination of such places as Umm el-Qeṭein, Umm ej-Jemâl, and Sabkhah, to underscore a previous statement: "We must regard Nabataean Syria rather as a colony controlled by Nabataeans than as a thickly settled part of the Nabataean state proper."[5] Nabataean officials and

[5] BULLETIN 85, p. 7.

tradesmen, troops and priests formed the governing minority of Nabataean Syria, but they ate from the dishes of their subjects and clients, eschewing perforce the fragile Nabataean ware produced at home in the heart of their kingdom.

In view of the absence of typical Nabataean pottery in the Umm ej-Jemâl region and its probable absence in all of Ḥaurân and Jebel Drûz, it was not surprising to find it missing in such parts of the Wâdī Sirḥân as the joint expedition of the School in Jerusalem and the Smithsonian Institution was able to examine. It is most likely therefore that it does not exist in any part of the Wâdī Sirḥân. We are still convinced that the Wâdī Sirḥân with its comparatively plentiful supplies of underground water was "the lifeline which maintained the undisturbed connection between the separated parts of the Nabataean kingdom in southern Syria and southern Transjordan."[6] The Wâdī Sirḥân led directly to Jauf, which was a splendid oasis, a great caravan center in north-central Arabia, and a strong Nabataean outpost. In April 1944, our joint expedition examined archaeologically the northern end and much of the west side of the Wâdī Sirḥân. I should like to take this opportunity of expressing our thanks here also to el-Farik Glubb Pasha, Officer Commanding the Arab Legion, to Broadhurst Bey and to Said Bey of the Arab Legion, whose assistance made the expedition possible.

The Wâdī Sirḥân extends from Azraq in northeastern Transjordan to within 10 miles of Jauf in north-central Arabia. It bends from northwest to southeast, is about 210 miles long and averages about 20 miles in width. In some sections, however, it is about 35 miles wide, and in others only 8. Jauf lies in its own small depression, which measures some 5 by 3 miles. About 12 miles east of it is the Skakā depression, which measures about 14 by 8 miles at its greatest extent. Whoever holds the Wâdī Sirḥân holds an important gateway from Syria into Arabia. Its northern end is in Transjordan proper, and its western side forms or is close to much of the eastern boundary of Transjordan. Most of the Wâdī Sirḥân belongs to the territory ruled over by King ʿAbd ul-ʿAzîz Ibn Saʿûd. Moslems may enter into it freely. For others, it is very difficult to obtain visas. Ibn Saʿûd has long been aware of the strategic importance of the Wâdī Sirḥân and is jealous of his prerogatives there. Its wealth lies in its water. It was mainly through the Wâdī Sirḥân that the Nabataeans were able to penetrate into southern Syria and to obtain a strong foothold there.[7]

The physical characteristics of the Wâdī Sirḥân are surprising to one who is accustomed to the topography usually associated with the term *wâdī*, which is roughly equivalent usually to our *arroyo*. The Wâdī Sirḥân is nothing at all like the Wâdī ʿArabah, for instance, or the Wâdī Ḥesā or Wâdī Môjib, or like any of the lesser *wudyân* which have been studied by the School's expeditions in the course of its archaeological survey of Transjordan. The Wâdī Sirḥân is a long and shallow depression, which in reality is an eastward extension of the flattish, flint-and-basalt-covered plain forming the eastern part of the Transjordan desert

[6] BULLETIN 85, p. 4.
[7] BULLETIN 85, pp. 6-7; *Annual*, XVIII-XIX, pp. 144-145.

east of Transjordan proper. The latter begins as a plateau, which slopes towards the west, gradually changing into hilly country, which finally falls down to the Jordan Valley, the Dead Sea and the Wâdī 'Arabah. This area is a huge catchment basin, which collects the rain water, and in numerous perennial streams brings much of it westward to the Dead Sea and the Jordan. From a line marked approximately by the Omaiyad castles of Qaṣr Ḥallābât, Qeṣeir 'Amrah, Qaṣr Kharâneh and Qaṣr eṭ-Ṭûbah, and by the Nabataean post of Bâyir, the slope of the watershed is eastward. The land slopes very gently eastward from this line down to the Wâdī Sirḥân. Actually, the slope is so gradual that when one comes from Qaṣr Kharâneh eastward to the Wâdī Sirḥân as I did, one finds that one has arrived in the Wâdī Sirḥân without having realized it.

It is worth emphasizing that the Wâdī Sirḥân merges almost imperceptibly with the flint- and basalt-covered *Ḥamad* desert which leads down to it ever so gently from the Transjordan side. Only northeast and east of the Wâdī Sirḥân are there ranges of hills, from which there is a marked descent to it. Physical maps marking the Wâdī Sirḥân and its surroundings are generally misleading, because they portray it in the same deep green, contrasting with the surrounding variations of brown, in which really deep *wudyân* are depicted in contrast to the brown of the hills or high plateaus through which, for instance, such a *wâdī* as the Wâdī Môjib (Biblical Arnon) cuts a path for itself. The Wâdī Sirḥân is a *wâdī* only in the sense that it is an extensive catchment basin for rain and run-off waters. On the whole it is so flat that one can ride about in it in an automobile at fairly high speed. I have witnessed the unsportsmanlike chase of gazelles by car in the northern part of the Wâdī Sirḥân. I understand that official personages have engaged in these large-scale gazelle hunts in the Wâdī Sirḥân proper, using as many as 50 cars at a time to run the fragile creatures to death. The point here is that the Wâdī Sirḥân is flat enough to permit such mechanized butchering expeditions to take place. One can as a result predict the speedy extermination of the gazelles of the Wâdī Sirḥân, just as the oryx and ostrich have been exterminated in other parts of Transjordan and Arabia.

The path of the Wâdī Sirḥân, as also the lateral approaches to it, are marked by minor *wudyân*, which, on the whole, are little more than rills or ripples in the ground, along which rain water runs off after an occasional downpour in winter and early spring. These frequently quite broad, furrowed, extremely shallow paths of run-off water, marked by thick growths of low bushes, make it somewhat bumpy for an automobile crossing them, but are otherwise no deterrent to travel.

It rains only infrequently in the eastern desert of Transjordan and the Wâdī Sirḥân, but I have seen it rain strongly for days on end, in which case large areas of the countryside, particularly in or near the Azraq region, become covered with sheets of water. Every hollow becomes a small reservoir, holding a considerable supply of water for days and weeks, and even for months at a place like Burqa'ah (Fig. 4) at the very northeasternmost corner of Transjordan. A ruined Roman-Byzantine police-post and caravanserai stands there, abandoned today but still the assembly point of Bedouins and their flocks for several months following the end of the rains, because of the formation of a great pool

of water in the adjacent, normally dry, *wâdī*-bed. This pool of water lasts large flocks for several months. The Bedouins search out every such hole in the desert where water collects after a rain storm, and lead

Fig. 4. Burqa'ah (photo Nelson Glueck).

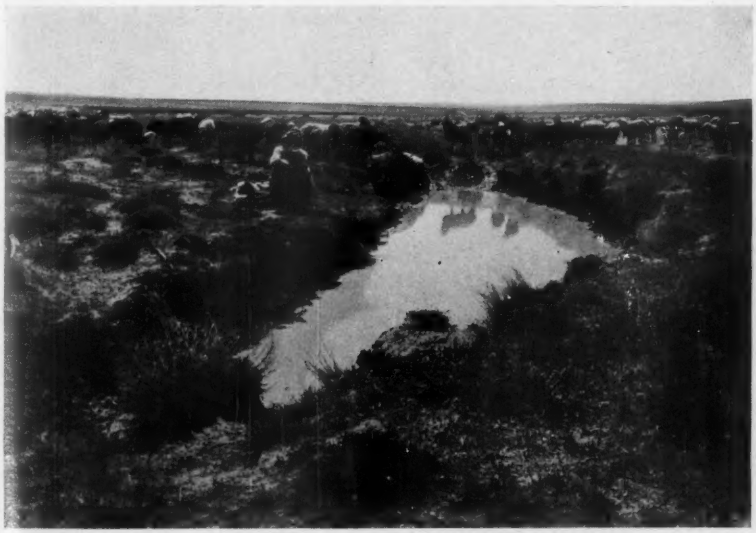

Fig. 5. Rain pool in natural depression east of Muwaqqer.

their flocks to them. Between Qaṣr Kharâneh and the Wâdī Sirḥân, several days after the last rain in the spring of 1944, I saw several flocks being watered at such places (Fig. 5). It is during this period of spring,

immediately following the rains, that the grim grey of the easternmost desert of Transjordan and of the Wâdī Sirḥân, becomes enveloped with an enchanting covering of green. It is then that one fully understands the words: "For, lo, the winter is past; the rain is over and gone; the flowers appear on the earth; the time of singing is come" (Song of Songs 2: 11, 12).

Rainwater runs off the southern slopes of the Jebel Drûz and the eastern side of the Transjordan watershed either on the surface or subterraneously into the Wâdī Sirḥân. It reappears then in several swampy (*sabkhah*) areas and at various water-holes along the length of the

Fig. 6. Water-hole at 'Amrī in the Wâdī Sirḥân (photo Nelson Glueck).

Wâdī Sirḥân. The largest collection of water there is contained in the marshes and lake of the Azraq depression, located at its northwest end. Dominating it are the ruins of a large mediaeval Arabic fort and caravanserai (which replaced an earlier Roman-Byzantine one) with a modern police-post and fort of the Arab Legion nearby. Azraq [8] was the end-station of the caravan route which leads along the Wâdī Sirḥân from Jauf en route to Syria.

About 25 kilometers south-southeast of Azraq, one comes to 'Amrī in the Wâdī Sirḥân. It is already well inside the Wâdī Sirḥân proper, and fortunately is still within the confines of Transjordan. It is about 85 kilometers due east of the Ḥejâz railway. Next to Azraq, the water

[8] Butler, *Syria*, II. A. 2, pp. 100, 110, 116; II. A. 4, p. 225; II. A. 5, ill. 281; III. A. 2, Appendix, pp. ix, xi.

obtainable at 'Amrī forms the best source of water supply in the entire Wâdī Sirḥân. The site of 'Amrī consists of a *sabkhah* area, about 5 sq. km. in extent. In numerous places the underground water wells up to the surface, and elsewhere it is possible to find it by digging down less than half a meter—it being sometimes necessary to break through a limestone layer about half a meter thick more or less (Fig. 6). When the desert sands or débris fill up one water-hole, or when the water becomes too foul to drink, it is a simple task to dig out another water-hole. From ancient times on, caravans have made 'Amrī a place to refill water-skins before proceeding on to Azraq or turning off westward towards 'Ammân or Mâdebā by the route that passes by Qaṣr Kharâneh and Muwaqqer.

When we arrived at 'Amrī, we found herds of camels grazing and drinking there. A couple of scrubby palm trees can be seen near one of the water-holes. Close to them is a sand-covered hillock, which looks as though it might conceal the remains of a small ruin. On and around it were fairly numerous Roman and Byzantine sherds. Indeed, scattered throughout the entire area one finds Roman and Byzantine sherds, although not in any quantity. Among the sherds were several pieces of sigillata. My disappointment with the sherds of 'Amrī was increased by the fact that, as I had feared, there was not among them a single indubitably Nabataean sherd. We looked in vain, furthermore, for the remains of some sort of a *qaṣr* or *khân*, but aside from the above-mentioned hillock, there seemed to be no ancient ruins whatsoever.

Our quest, however, was not to prove completely in vain. About a kilometer south of this *sabkhah* area of 'Amrī, we came across the ruin of a very large caravanserai, which stretched over an area almost a kilometer long. It was at this site, which for want of a better designation I am calling Khirbet 'Amrī, that the caravans halted, while their beasts were watered at the wells of 'Amrī proper and then grazed nearby (Fig. 7). The buildings of Khirbet 'Amrī, preserved in a sadly ruined state, seemed to consist of single rooms or series of chambers, constructed in one story of soft sandstone, which crumbles practically at a touch. There are long hillocks formed by such structures, whose ruins are almost completely covered over with débris. Very large quantities of Roman and particularly of Byzantine sherds were found around them. And again, among all the thousands of sherds which I examined there, not one could be claimed as Nabataean.

From the pottery remains examined at 'Amrī and elsewhere in the Wâdī Sirḥân, I am now confident that none will be found in any quantity comparable to what can be found on any of the hundreds of Nabataean sites in southern Transjordan. This fact does not detract from the strategic importance of the Wâdī Sirḥân as an important highway between widely separated parts of the Nabataean kingdom, any more than the absence of Nabataean sherds at Umm ej-Jemâl or Sabkhah negates the presence of Nabataeans and Nabataean influence there or in the rest of the Ḥaurân and Jebel Drûz. It is, on the other hand, important to note that a Nabataean inscription was recently discovered at Jauf, which does contribute to the evidence that Jauf and the Wâdī Sirḥân in general were of importance to Nabataean economy.

Fig. 7. Camel-herds of the Sherâreh Arabs at 'Amrī in the Wâdī Sirḥân (photo Nelson Glueck).

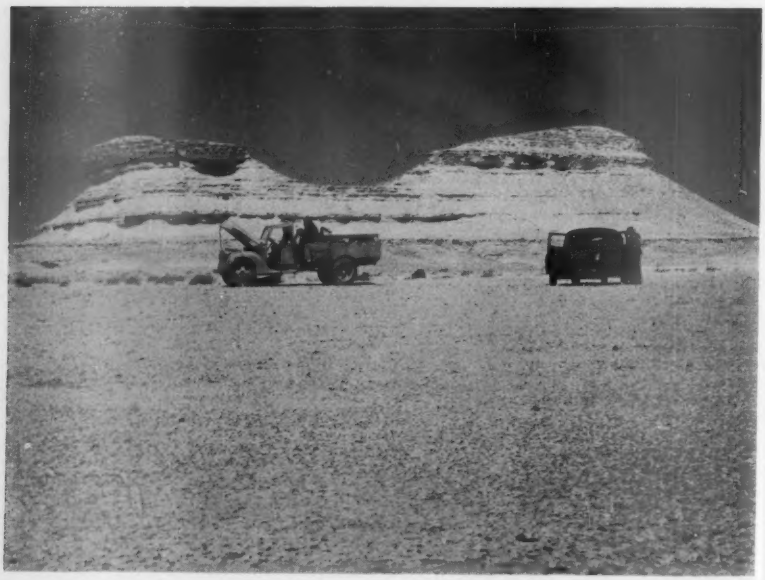

Fig. 8. Jebel Dhewâyil near Wâdī Khadraj (photo Nelson Glueck).

From 'Amrī we drove south-southeast along the western edge of the Wâdī Sirḥân for about 150 kilometers, coming finally to the very shallow Wâdī Khadraj, which runs into the Wâdī Sirḥân. There, at a point called Meshâsh Khadraj, about 175 kilometers east of the Ḥejâz railway, are half a dozen water-holes dug into the dry bed of the *wâdī*. They tap underground water, which rises to a level little below the surface. It was anciently an important caravan station. On the slope of the small hill opposite it we found early flints, as well as numerous Roman and Byzantine sherds. This place is about 25 kilometers west of the Wâdī Sirḥân (Fig. 8).

From Wâdī Khadraj one can journey directly to the Jebel Ṭubaiq, where in 1932 a joint expedition of the School in Jerusalem and the Transjordan Department of Antiquities visited and recorded the prehistoric rock-drawings of Kilwā and the Christian monastic settlement there.[9] We returned to 'Ammân via Bâyir, which I have described elsewhere.[10] A fine Nabataean castle once existed there to guard the deep wells, and wherever one turns, one can find innumerable fragments of fine, fragile, Nabataean sherds, many of them decorated with the painted designs so characteristic of Nabataean pottery. This contrasts distinctly with the pottery finds in the Wâdī Sirḥân and Umm ej-Jemâl regions. At a place like Bâyir, which was a strong outpost of the sedentary, agricultural, part of the Nabataean kingdom, and which was also an important crossroad for caravans branching off from or going to the Wâdī Sirḥân via Petra, Jafar, and Bâyir, it is understandable that Nabataean pottery should be found in large quantities. It was garrisoned by Nabataeans who were at home in some of the numerous towns of Nabataean Transjordan, and who, together with the Nabataean tradesmen located there, demanded the familiar wares of their home households. Similarly, along the Nabataean trade-route leading across the Wâdī 'Arabah to Gaza and Ascalon via Kurnub and the cities of the Negeb,[11] there were apparently large, homogeneous, communities of Nabataeans, who preferred their own pottery. It took, furthermore, but a comparatively short haul to bring it to them, inasmuch as there seems to have been extensive production of this pottery at Bîr Madhkûr in the Wâdī 'Arabah.[12]

This Nabataean pottery, as has been pointed out in detail in *Annuals* XIV, XV, and XVIII-XIX, has been found by the Jerusalem School's archaeological expeditions on hundreds of sites in the southern part of the agricultural section of Transjordan. The spread of this pottery extended then as far east as Bâyir, but not as far as the Wâdī Sirḥân. It reached westward generally as far as the Wâdī 'Arabah, and, as has just been pointed out, along the Nabataean trade-route which led to the Mediterranean coast of Palestine. The conclusion is therefore that the typical Nabataean pottery was produced and used primarily only in the thickly settled, agricultural, part of the Nabataean kingdom in southern Transjordan, whose metropolis was Petra.

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[9] JPOS XVI, 9-16; *The Other Side of the Jordan*, pp. 43-49.
[10] *Annual* XIV, pp. 73-75. [11] *Annual* XV, 16. 114. [12] *Annual* XV, 35-37.

DILMUN, THE LAND OF THE LIVING

S. N. KRAMER

It is now more than a quarter of a century since Arno Poebel published the "deluge" tablet, whose contents furnished the first definite proof that the Sumerian priests and poets had developed the concept of an "Abode of the Blessed" not unlike that of the much later Homeric Elysian Plains.[1] According to the "deluge" portion of this poem, the gods have decided to destroy mankind by means of a flood. But Ziusudra, a pious, god-fearing king, is forewarned of the gods' decision by Enki, the god of wisdom, who advises him to construct a huge boat. This he does, and thus finds safety and shelter from the destructive deluge which lasted seven days and seven nights. On the eighth day the sun-god Utu appears, and Ziusudra prostrates himself and brings sacrifices to him. Finally An and Enlil grant him eternal life and apparently place him in Dilmun "the place[2] where the sun rises."

Now it is the location of this land Dilmun which has troubled scholars all these years. One group has defined it as a land bordering on the eastern shore of the Persian Gulf, and extending, to put it very roughly, from somewhere south of Elam to the Strait of Ormuz.[3] Another group has identified Dilmun with the island of Baḥrein in the Persian Gulf.[4] A careful reading of the arguments will convince the student that all efforts at a solution of the problem have reached more or less of an impasse; on the basis of the evidence brought to light to date, it is impossible to decide one way or the other. It is the primary purpose of this study to present new data, as well as to clarify some misunderstood or neglected older data, which prove that in all probability it is in southwestern Iran, as suggested by the first-mentioned group of scholars, where Dilmun is to be sought, and that it is not to be identified with the island of Baḥrein. At the same time this new and reinterpreted material will furnish a number of interesting details relating to the Sumerian picture of the "Abode of the Blessed," or as the Sumerians themselves probably designated it, the "Land of the Living."

First, then, the passage in the Sumerian "deluge" myth which is basic and crucial for the entire problem. After Ziusudra had been granted life everlasting and an eternal soul, the text continues with the line[5] kur-bala kur-dilmun-[6]na ki-[d]utu-è-a-šè[7] mu-un-ti-eš, "They (An and

[1] This is the poem utilized by the Babylonian authors of the Epic of Gilgameš as the basis for its eleventh, or "deluge," tablet; for details, cf. *JAOS* 64. 15 ff.

[2] So, instead of "land" as in *JAOS* 64. 16.

[3] Cf. especially Jensen, *ZA* 15. 225; Poebel, *PBS* IV 1. 62; Langdon, *PBS* X 1. 9 f., who includes some of the islands off the coast.

[4] Cf. especially Albright, *AJSL* 35. 182 ff. and *JAOS* 45. 237 f.; Landsberger, *ZA* 35. 217, note 2; Burrows, *Orientalia* 30. 3 ff.; Deimel, *ibid.* 25 ff.

[5] *PBS* V No. 1 vi 12.

[6] The sign read above as dilmun was transliterated as dilmun with a question mark by Poebel, the scholar who copied the tablet and who prepared the edition of its contents which is still standard (cf. note 1); he was troubled by the sign as it appeared on the tablet (No. 1 on our accompanying cut) which resembles SAL.UR$_4$ (cf. *PBS* IV 1. 61, note 4; he describes the second part of the sign as KIN or KAR, but actually it resembles UR$_4$), and varies considerably from the expected form (No. 2

Enlil) caused him (Ziusudra) to dwell in the land[8] *of the (sun's) crossing*, in Dilmun, the place where the sun rises."[9] Since our tablet expressly

on our cut) which resembles NI.TUK. (The reader is asked to bear in mind that the statements that the sign for dilmun resembles NI.UR$_4$, or NI.TUK, are not intended to imply in any way that there is some etymological connection between the sign for dilmun and any of the possible meanings of NI.TUK or NI.UR$_4$. Such speculations as those found in *Orientalia* 30. 4 ff. are not to be taken seriously; they result from the type of superficial and factitious etymologizing which, fortunately for Oriental scholarship, is gradually becoming a matter of the past.) Because of Poebel's doubt as to the reading of the sign, and because the line involved is basic to our entire problem, it is advisable to go into the matter in some detail.

Let us realize first of all that while it is true that in all our late Accadian material, as well as in such early texts as *Gudea Statue* D iv 10, or *PBS* XV pl. III v, vi 12, the sign for dilmun is made to resemble more or less the combination NI.TUK, this is by no means the general rule in the literary texts of the early post-Sumerian period, when our "deluge" tablet was actually inscribed. Indeed of all the examples known to me from the literary texts of this period (excluded are *TRS* 9 vi 21, and *OECT* pl. 15. 8, whose copies are obscure) only two resemble the combination NI.TUK; these are *PBS* X 2 No. 1 ii 2 (= Langdon's No. 4562 in *PBS* X 1. 8, note 1) where a collation of the original revealed the sign to be No. 2 on our cut, and not as drawn by Langdon, and *CT* XV 27. 7 (cf. already Langdon, *PBS* X 1. 8, note 1). In all the other literary texts of the early post-Sumerian period, excepting for the moment the "Dilmun" tablet, *PBS* X 1 No. 1 (cf. note 22), the sign is made to resemble SAL.TUK (No. 3 on the cut) rather than NI.TUK; cf. *PBS* X 4 No. 7 rev. 14, 19; *PBS* V 157 i 2 and *VS* X 199 rev. iii 32 (note the interesting fact that in the same é-dilmun-na in the Warad-Sin historical inscription, Gadd and Legrain, *Royal Inscriptions* 127. 32, the sign for dilmun resembles NI.TUK); VS II 5 ii 27; *TRS* 39. 37; *SRT* 6 iii 20-1 = *ibid.* 7. 31-2. (The same holds true of such lexical texts as *SLT* 15 xi 17, 17 vii 5, and 170 ii 13).

Now when it comes to the "Dilmun" tablet, *PBS* X 1 No. 1, the sign, as already noted by Langdon in his note 1 on p. 8, appears in *two* forms. In both forms the *first* part of the sign resembles SAL (not NI); the variation concerns the second part of the sign which in some cases is made to resemble the expected TUK, but in others, to resemble UR$_4$. Thus, to take only the more certain examples, the reader will find by turning to the photograph of the tablet, *ibid.* pls. v and vi, that the sign for dilmun appears as SAL.TUK in i 5, 6, while it appears as SAL.UR$_4$ in i 13, 33; ii 3, 6, 14, 18; also in the very last line on the reverse of the tablet. Not only that, the SAL.UR$_4$ form itself, is not made uniform throughout the tablet. Thus while in case of i 13, 33 and ii 6, its form is that of No. 4 on our cut, in the remaining instances, its form is that of No. 5 on the cut. Nor is there any doubt as to the reading dilmun for the SAL.UR$_4$ form of the sign (cf. Jastrow's uncertainty in *AJSL* 33. 103); it is assured beyond reasonable doubt by the last line of the tablet, which reads [^{d}en-ša$_6$]-ag en-SAL.UR-na ḫé-a, since the deity whose name is here written as ^{d}en-ša$_6$-ag (the name Enshagag in *SM* 58 is to be corrected to read Enshag) is certainly identical with ^{d}en-zag, expressly described as the god of Dilmun in *CT* XXV 35. 20, where the sign for dilmun is the expected NI.TUK. Now, what is most important, it is this SAL.UR$_4$ form of the sign for dilmun which appears in Poebel's "deluge" tablet, *PBS* V 1 vi 12; its reading as dilmun, hitherto in doubt, may now, in the light of the evidence just sketched, be considered as reasonably certain.

[7] Cf. lines 79-83 of "Inanna's Descent to the Nether World" (*PAPS* 85. 298) where line 80 should perhaps have been translated to read "I am Inanna *of* the place where the sun rises" (similarly line 81). It is not improbable, therefore, that Inanna, like Utu, was conceived as living primarily in Dilmun (cf. also note 28). Hence it is that according to the well known and oft-quoted passage *ASKT* p. 127, 35 ff., Inanna bathes her head in the well of Dilmun; hence, too, her well known temple é-dilmun-na in Ur (cf. *PBS* V 157 i 2; *VS* X 199 rev. iii 32; *OECT* pl. 15. 8).

[8] For the translation of kur as "land" rather than as "mountain," cf. notes 13 and 24.

[9] For the doubtful translation "land of the (sun's) crossing," cf. lines 13-14 of

describes Dilmun as the "land where the sun rises," it must be sought quite obviously east of Sumer. And since it is hardly likely that the island of Baḥrein, hugging the Arabian coast, would be conceived by the Sumerians as lying east of their own land—it is much more likely that it was conceived as south of Sumer—the evidence of this line alone points rather clearly to the location of Dilmun in western Iran. If now we add the fact that Dilmun is regularly coupled with Magan and Meluḫḫa, and that in the Assyrian historical inscriptions it is described as situated immediately below Bit-iakin,[10] all of which are to be sought south of Sumer,[11] it is in the more southerly part of western Iran, that is, somewhere south of Elam, where Dilmun is to be sought.[12]

Another fairly conclusive proof that Dilmun is to be sought east of Sumer and south of Elam, would follow if we could assume that the kur-^{giš}erin-na, "the land[13] of cedars," in the geographically oriented list (kur-^{giš}erin-na, Elam, Marḫaši, Gutium, Šubur, Martu, Sutium, kur-é-an-na) in the Lugalannimundu inscription,[14] refers to Dilmun. And we have some good evidence that this is actually the case. For as already noted, Dilmun is described as ki-^{d}utu-è-a-šè, "the place where the sun rises," and in *CT* 36, 34. 3[15] we read: ^{d}utu kur-šim-^{giš}erin-na-ta è-a-ni, "Utu, who rises (literally 'his rising is') from the land

the Utu hymn *BA* 10. 1 ff., where Utu is described as crossing the land of Ḫašur, and for the probable identification of Ḫašur with Dilmun, cf. note 17. Note, too, the very significant line in the Utu hymn *TRS* 79 obv. i 35 = *PBS* I 2 No. 118 obv.(!) i(!) 35(!) (in the last named text, obv. and rev. are to be interchanged, and on plate CXXIV as well as CXXV, the piece copied to the right is actually a continuation of the piece copied to the left, and the lines of the two pieces are therefore to be numbered consecutively) which in spite of the copyists reads: ^{d}utu kur(!)-erin(!)-na(!) kur(!)-ḫa(!)-šu-ra za-a-kam, "O Utu, thine is the land of cedar, the land of *ḫašur*"; this line may well refer to Dilmun as a land of both cedar and *ḫašur*. The land Ḫašur is again referred to in line 17 of the obv. of the same hymn, whose first part reads kur-ḫa-šu-ra-ke$_4$ in *TRS* 79, and kur-ḫa-šu-úr-ra(!)-ke$_4$ in *PBS* I 2 No. 118; the reading and meaning of the second half of the line, however, are uncertain. Finally, Utu is designated as "the lord of the *ḫašur*-forest" in the first half of line 12 of the obv. of *VS* II 73 which reads: šul ^{d}utu-en-·tir-ḫa-šu-úr-ra. For a different translation of kur-bala, cf. Burrows, *Orientalia* 30. 10, and Deimel, *ibid.* 29.

[10] For references cf. under Dilmun in the index to Luckenbill's *Ancient Records of Assyria and Babylonia.*

[11] Though the location of Magan and Meluḫḫa is still far from certain (cf. Albright's succinct résumé in *JAOS* 45. 238 ff.) all scholars agree that they are to be sought south of Sumer. Note, too, that if the *ebirtân* (BAL.RI) of line 42 of *KAV* 92 which reads *dilmun^{ki} mà-gan-na^{ki} mâtâti ebirtân tâmti šapliti*, should prove to be a dual, the line is to be rendered "Dilmun and Magan, the lands of the two opposite sides of the lower sea." The location of Dilmun and Magan would thus be relatively assured, with Magan as the land bordering on the western shore of the Persian Gulf, and Dilmun bordering on the opposite, eastern shore of the Persian Gulf.

[12] Note, too, that in spite of the break in the text and the difficulty with the phrase *ša nibiri*, the contents of the second column in the Naramsin text *CT* XIII 44 (cf. Güterbock, *ZA* 42. 71 ff.) points to Dilmun as a land situated south of Elam.

[13] Note again that kur is best translated as "land" rather than as "mountain"; it is used in the Lugalannimundu inscription alongside of kur-é-an-na which, no doubt, refers to Sumer, a land that can hardly qualify as mountainous. Cf. also note 24.

[14] For details, cf. *JAOS* 64. 13, note 48.

[15] Cf. also *ibid.* line 5. The text is a hymn addressed to Inanna describing the love and devotion of her husband Dumuzi.

of aromatics and cedars." Since it is hardly likely that the kur-^{giš}erin-na and the kur-šim-^{giš}erin-na are not identical, and since it, like Dilmun, is the place where the sun rises, it is not unreasonable to assume that Dilmun and kur-^{giš}erin-na could be used synonymously in our literary texts.

But if it is true that kur-^{giš}erin-na could be used as another name for Dilmun in the Sumerian literary compositions, the latter might be expected to contain some tangible evidence that Dilmun was noted as a land of cedars. Let us therefore proceed to analyze two passages which make it fairly certain that Dilmun was known for its cedars. The first passage, part of a Tammuz lament in the Emesal dialect, reads as follows (the speaker is either a priest or a deity):

zag-mu ^{giš}erin-àm gaba-mu ^{giš}su-úr-man-àm
e-me-da-zag-si-mu ^{giš}erin-a-ru-àm
^{giš}erin-a-ru-àm-ḫa-šu-úr-ra-ka
mu-gi$_6$-gi-dilmun-a-ka[16]

My shoulder is the cedar, my breast is the cypress,
My . . . is the consecrated cedar,
The cedar, the consecrated of Ḫašur,[17]
The *tabooed* of Dilmun.[18]

[16] Cf. especially Albright, *AJSL* 35. 180, where will be found variants and references.

[17] Since the last two lines of the passage are in all probability parallel hemistichs (hence, therefore, the omission of the last line in the variant) we may conclude that the name Ḫašur could be used as another name for Dilmun in our literary texts. This conclusion is further corroborated by the fact noted above that Dilmun is described as kur-bala, probably, "the land of the (sun's) crossing," and that Ḫašur, too, is referred to as the land which the sun crosses immediately upon rising; cf. note 9. Moreover, to judge from several passages in the literary texts, the location of Ḫašur points to its identification with Dilmun. For if, as is not unlikely, the first complex in *OECT* pl. 9. 41 reads kur-ḫa-šu-ùr-ra "*in* the land Ḫašur, then, in spite of the obscurity of the second half of the line, we may conclude that the city of Aratta (cf. the preceding two lines; for the reading of LAM.KUR.RU as *aratta*, cf. *JAOS* 63. 192, note 2) was located in Ḫašur. Now this city of Aratta, venerable in Sumerian epic lore, is situated in a land adjacent to Anšan, since according to the passage cited below (p. 26) Lugalbanda found it necessary to traverse Anšan from "side" to "head" to reach it (cf. note 32). And since fortunately the location of Anšan as a country immediately to the south of Elam is relatively assured (cf. Poebel, *PBS* IV 1. 234, and Albright, *JAOS* 45. 198; König in *RLA* I 111 takes a different view, but as the editors of the *RLA* point out, he has ignored some of the more significant evidence), it follows that Ḫašur, too, is to be sought somewhere south of Elam, *i. e.* in the same general direction adduced above for Dilmun.

Another indication that Dilmun is to be identified with Ḫašur, the land in which the city of Aratta was probably situated, can be seen in the fact that both Dilmun and Aratta are expressly described as kur-me-sikil-la, "the land of the pure decrees" (cf. *VS* II 5 ii 27 and *HAV* 17 rev. 2, 4). And it is not improbable that *Šurpu* IX 42 ff. (cf. Albright, *AJSL* 35. 179) refers to Ḫašur as kur-ki-sikil-la, "the land, the pure place," just as the first lines of the "Dilmun" tablet (*PBS* X 1 No. 1. 1 ff.) describe Dilmun as a pure place. Note finally that the phrase ḫašur-nu-zu-kur-a(k) (cf. *SEM* 1 i 37; *CT* XV 42 rev. 7; *ibid.* 43 obv. 1) is unfortunately surrounded by contexts which are still not quite clear to me, and that *KAR* 34. 13-15 (cf. Albright, *AJSL* 35. 176) remains difficult.

[18] The translation "tabooed" for mu-gi$_6$-gi, which seems to be demanded by the context as a parallel to a-ru-àm "consecrated" of the preceding line, assumes that it is the Sumerian word for *ikkibu*. To be sure this Sumerian word which read íg-gig in the Eme-KU might have been expected to appear as mu-gi(g)-ib or

Dilmun, therefore, must have been noted for its cedars. Moreover it is not unlikely that these were conceived as holy cedars by the Sumerian poets, and that it was one or more of these tabooed cedars which Gilgamesh (cf. *JAOS* 64. 13 ff.) was determined to fell.

The second passage is from a Ninisinna hymn copied by Edward Chiera in the Istanbul Museum of the Ancient Orient and published twenty years ago; it reads as follows (the speaker is Ninisinna): [19]

é-mu kur-dilmun^{ki}-nu-me-a ^{giš}erin(!)-ta ba-an-tu
ì-si-in^{ki} kur-dilmun^{ki}-nu-me-a ^{giš}erin(!)-ta ba-an-tu
My house, before Dilmun existed, was fashioned from *cedar*,
Isin, before Dilmun existed, was fashioned from *cedar*.

Now, the sign which I read above as erin(!) "cedar," is actually GIŠIMMAR "palm tree" (sign 6 on the cut), not ERIN (sign 7 on the cut);

the two signs resemble each other not a little, and because of the context, I felt justified in assuming that GIŠIMMAR is a miscopy for ERIN. For it is an unfortunate fact that Chiera who, it will bear stressing, was one of our most accurate copyists, seems to have been unaware at the time he was autographing the Istanbul material for his *SRT*, that the scribes of our literary texts regularly distinguish between the two signs GIŠIMMAR and ERIN. For example in *SRT* 1 v 23 and 31, the sign GIŠIMMAR is a miscopy for ERIN, as is proved by the following -na in both examples, and by Radau's duplicate, *HAV* 2. 38, where the sign is correctly copied as ERIN. Again in *SRT* 15. 38, in the complex tir-šim-^{giš}erin-na, the sign ERIN is miscopied as GIŠIMMAR. And finally in the very hymn under discussion, in the complex tir-šim-^{giš}erin-na (*SRT* 6 iii 18 = *ibid.* 7. 29) the same miscopy occurs.[20] In view of these facts, my suggestion that

mu-gi(g)-bi in our text which is written in the Emesal (for an example of Eme-KU níg = Emesal mu in a compound substantive, cf. *AS* 12. 90, comment to line 271) just as e. g. the Eme-KU nu-gig for Accadian *ištarîtum* becomes mu-gi(g)-ib or mu-gi(g)-bi (written also mu-gi-bi) in the Emesal. It is not impossible, therefore, that we must assume that mu-gi$_6$-gi for the expected mu-gi(g)-bi represent a hybrid orthography, part Eme-KU and part Emesal; at present, however, I am unable to point to any other examples of this phenomenon, although we have, of course, numerous examples of Eme-KU orthography in Emesal texts (cf. *AS* 12. 7 ff.). Another possible translation for mu-gi$_6$-gi is "shade," under the assumption that it is the Emesal form for giš-GI$_6$ whose reading would thus be giš-gig; the cedar would then be designated as "the shade of Dilmun." This translation, too, makes excellent sense, but the parallelism with a-ru-àm of the preceding line is destroyed. In any case, whichever translation should turn out to be correct, the line points to Dilmun as a land noted for its cedars.

[19] I discussed the text briefly in *JAOS* 64. 13, note 48, where the reader will find the necessary references. However, since the passage is significant for the argument, and since my translation involves the correction of a sign in Chiera's copy — and Chiera's copies are usually outstanding for their accuracy — it is advisable to go into the matter in some detail.

[20] Fortunately by the time he copied *SEM* and *STVC*, Chiera seems to have realized the distinction between the two signs; cf. e. g. the correct form of the sign in

the sign GIŠIMMAR in our cited passage is a miscopy for ERIN, obtains, of course, a much more reasonable coloring. For while it may be true that houses in Sumer were roofed at times with palm trees, it seems rather unlikely that the poets would make it the proud boast of Ninisinna that her house was built of palm trees, which, after all, must have been fairly common all over Sumer; it seems much more probable that it was of cedars which she boasted.[21]

In the preceding paragraphs a number of long-known passages from the Sumerian literary compositions have been utilized to show with a fair degree of probability that Dilmun was situated east of Sumer and south of Elam, and that it was known as a land of cedars. For added confirmation let us turn now to the new data furnished by the Sumerian epic tale "Gilgamesh and Ḫuwawa," which deals with Gilgamesh's quest for immortality.[22] The first part of this poem reads as follows:

1. The lord, toward the land of the living set his mind,
   The lord Gilgamesh, toward the land of the living set his mind,
   He says to his servant Enkidu:
   "O Enkidu . . . . ,
5. I would enter the land, I would set up my name,
   In its places where the names (of the gods) have been raised up,
   I would raise up my name,
   In its places where the names have not been raised up, I would
   raise up the names of the gods."

   His servant Enkidu answers him:
   "O my master, if thou wouldst enter the land, inform Utu,
10. Inform Utu, the hero Utu,
   Utu, the creature of the land,
   Inform Utu, the hero Utu, the creature of the . . cedar land."

   Gilgamesh laid his hands on an all-white kid,
   A *brown* kid, an offering, he pressed to his breast,
15. In his hand he placed the silver staff of his . . ,
   He says to Utu of heaven:
   "O Utu, I would enter the land, be thou my ally,
   I would enter the . . cedar land, be thou my ally."

   Utu of heaven answers him:

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gišerin nam-me (*SEM* 16 v 16); gišerin-sìg-gi (*SEM* 23 i 6); gišerin-nu-me-a and gišerin-kug-ga (*SEM* 51 i 3, 7). Interestingly enough, in his transliteration of *SEM* 51 which he had prepared evidently before copying the text and which appeared in *SRT* (p. 15 ff.) Chiera read the sign incorrectly as $šag_5$ (i. e. GIŠIMMAR) and translated it wrongly as "palm" instead of "cedar."

[21] It is only a collation of the original, of course, which can have the final say; let us hope this will be possible in the not too distant future.

[22] For full details together with a summary of its contents, cf. *JAOS* 64. 13 ff. and *ibid.* 83. It was in the course of preparing the scientific edition of this poem that I became convinced of the advisability of making a thorough investigation of the "Dilmun" problem. This investigation has resulted in two studies, the present one, concerned with Dilmun's location, and one planned for the following issue of the BULLETIN, which will consist of the scientific edition of "Enki and Ninḫursag," the poem published by Langdon under the title "The Sumerian Epic of Paradise, the Flood, and the Fall of Man"; cf. *SM* 54 ff.

20. "For the young men . . . . verily thou art, but what art thou to the land?"

(Gilgamesh answers him:)
"O Utu, a word I would speak to thee, to my word (*bend thy ear*),
. . I would speak to thee, give ear to it.
In my city man dies, oppressed is the heart,
Man perishes, heavy is the heart,
25. I climbed the wall,
Saw the . . . dead bodies *floating* on the river,
Let me not be treated thus; so be it.
Man, the tallest, cannot reach to heaven,
Man, the wisest, cannot cover the earth.
30. . . . .,
I would enter the land, I would set up my name,
In its places where the names (of the gods) have been raised up, I would raise up my name,
In its places where the names have not been raised up, I would raise up the names of the gods."

Utu accepted his tears as an offering,
Like a man of mercy, he showed him mercy.[23]

Note, then, that our poem speaks of the land to which Gilgamesh journeyed in his search for immortality as a "Land[24] of the Living,"[25]

[23] Since the scientific edition of the poem including a complete transliteration and translation is to appear in the not distant future, I shall here give the Sumerian of the first twelve lines only; these include all the words and phrases germane to our discussion (for the contents of lines 28-9, cf. Langdon, *Babyloniaca* VII 208. 37-8):

1. en-e kur-lú-ti-la-šè geštug-ga-ni na-an-gub
2. en-^{d}gilgameš-e kur-lú-ti-la-šè geštug-ga-ni na-an-gub
3. arad-da-ni en-ki-du$_{10}$-ra gù mu-un-na-dé-e
4. en-ki-du$_{10}$ sig$_4$-kal-e-ti-la sag-aš-bi-šè la-ba-ra-an-è-a
5. kur-ra ga-an-tu mu-mu ga-àm-gar
6. ki-mu-gub-bu-ba-àm mu-mu ga-bí-ib-gub
7. ki-mu-nu-gub-bu-ba-àm mu-dingir-ri-e-ne ga-bí-ib-gub
8. arad-da-ni en-ki-du$_{10}$-e imim mu-un-ni-ib-gi$_4$-gi$_4$
9. lugal-mu tukum-bi kur-ra i-in-tu-tu-dè-en ^{d}utu ḫé-me-da-an-zu
10. ^{d}utu šul-^{d}utu ḫé-me-da-an-zu
11. kur-ra dím-ma-bi ^{d}utu-kam
12. kur-^{giš}erin-kud dím-ma-bi šul-^{d}utu-kam ^{d}utu ḫé-me-da-an-zu

[24] For the translation of kur as "land" rather than as "mountain," note the use the verb tu(r) "enter" rather than e$_{11}$ "ascend" in lines 5 and 9; the contents of lines 6 and 7 seem to point to the same conclusion. Similarly such expressions as kur-dilmun and kur-ḫašur may no doubt be translated "the land Dilmun" and "the land Ḫašur," as well as "Mt. Dilmun" and "Mt. Ḫašur." And while obviously kur must at one time have been used to designate mountains and mountainous lands only, the fact is that such a lowland as Sumer is described as kur-gal; cf. line 6 of the passage transliterated in *SM* 107, and *PBS* X 2 No. 1 ii 11. Note, too, that in the frequently used complex kur-kur "all the lands," kur refers to lowlands as well as highlands. Cf. finally, notes 8 and 13.

[25] For the translation of lú-ti-la as "the living" (I had not realized this correct rendering when preparing the Gilgameš study in *JAOS* 64. 7 ff.), cf. lú-ti-la "the living" opposed to lú-ug$_5$-ga "the dead" in the Utu hymn *PBS* I 2 No. 118 obv.(!) ii(!) 35(!), 36(!); for the numbering of column and line in this text, cf. note 9.

s a land of cedars,[26] and as a land whose "creature" is the sun-god tu.[27] But as we have seen above, all three descriptions are particularly pplicable to Dilmun. For Dilmun may well be designated as a "Land the Living," since Ziusudra was settled there by the gods after he ad been granted immortality;[28] it was probably a land noted for its edars; finally it is expressly described as "the place where the sun ses." We are not unjustified in concluding, therefore, that Dilmun was he land to which Gilgamesh journeyed in quest of eternal life.

[26] That the TAR of the complex gišerin-TAR is to be read kud, I now realize from the complex gišerin-kud-da of *SBH* 23 obv. 24 (cf. *BL* 72. 18); the meaning of kud-da in the phrase gišerin-kud-da, however, remains uncertain.

[27] For the translation of dím-ma as "creature," cf. e. g. IV R 1 i 22; the implication seems to be that Utu was born of his parents Nanna and Ningal in the kur-gišerin-kud.

[28] Thus it is highly probable that it is Dilmun as a "land of the living" which is described in considerable detail and in typical Sumerian style in lines 13-30 of the "Dilmun" poem "Enki and Ninḫursag." These lines read as follows (the transliteration and supporting commentary will appear in the following issue of this BULLETIN; cf. note 22 and note carefully that the translation in *SM* 55 is to be modified accordingly):

In Dilmun the raven utters no *cries*,
The *ittidû*-bird utters not the *cry* of the *ittidû*-bird,
The lion kills not,
The wolf snatches not the lamb,
Unknown is the kid-killing *dog*,
Unknown is the grain-devouring ..,
Unknown is the .... widow,
The bird on high ..s not its ..,
The dove *droops* not the head,

The sick-eyed says not "I am sick-eyed,"
The sick-headed (says) not "I am sick-headed,"
Its (Dilmun's) old woman (says) not "I am an old woman,"
Its old man (says) not "I am an old man,"
The maid bathes not, she pours not sparkling water in the city,
He who crosses the river (i. e. of the Nether World?) utters no ...,
The *wailing priest walks not round about him* (i. e. the one crossing the river?),
The singer utters no *wail*,
By the side of the city he utters no *lament*.

A closer analysis of the passage reveals that it probably consists of an obliquely phrased description of Dilmun as a land where there is neither sickness, old age, nor death; the only line which seems to speak against this interpretation is line 26 ("The maid bathes not" etc.), and even then, on the surface only, since the implications of the line are far from certain. (Although Jastrow, *AJSL* 33. 91 ff., is more than justified in his criticism of Langdon's interpretation of the "Dilmun" poem as a whole, the fact is that in respect to this particular passage, Langdon's suggestion that it consists of a paradise motif is considerably closer to the truth than that of Jastrow, Witzel (*Keilinschriftliche Studien* I 70), and Barton (*Archaeology and the Bible* 337) that it describes a condition of chaos before the appearance of life and civilization.)

Another interesting problem in connection with Dilmun as the land of immortals and one that has no doubt already come to the reader's mind, is whether Dilmun, or some mountain in Dilmun, was conceived by the Sumerians as the gathering place of their gods (cf. e. g. the *mûšab ilâni* designation of the cedar mountain in the fifth tablet of the Epic of Gilgameš). Thus we find there Utu, and probably Inanna (cf. note 7), and according to the "Dilmun" poem, Enki, Ninḫursag, and a whole host of divinities seem to be at home there; we even find an assembly of the gods, with Enlil in charge, taking place in Dilmun (cf. for the present *SEM* 57). On the other hand we have the well known fact that each important Sumerian deity seems to dwell in his own particular city, Enlil at Nippur, Enki at Eridu, Nanna at Ur, etc., etc. Moreover these gods may visit each other (cf. *SM* 47 ff., 62 ff., 64 ff.), and in one case, at least, an assembly of the gods takes place in Nippur (cf. *SM* 63).

With the probability established that Dilmun is the land referred to as kur-lú-ti-la and kur-^{giš}erin-kud in our "Gilgamesh and Ḫuwawa" poem, we have a new proof that Dilmun is to be sought in southwestern Iran. For in order to reach the land where he hoped to find the secret of immortal life from his city Erech, Gilgamesh had to cross seven mountains.[29] Now in the Epic "Lugalbanda and Enmerkar"[30] Lugalbanda's journey from Erech to Aratta, undertaken for the purpose of delivering Enmerkar's message of distress to his (Enmerkar's) sister, Inanna of Aratta, is described as follows:

zag-an-ša$_4$-an-ta sag-an-sa$_4$-an-na-šè (!)[31]
ḫur-sag-5 ḫur-sag-6 ḫur-sag-7 im-me-ri-bal-bal
.... arrata^{ki}-aš ba-te
From the "side" of Anshan to the "head" of Anshan,
Five mountains, six mountains, seven mountains he crossed,
.... he arrived at Aratta.[32]

Since it is more than unlikely that the seven mountains crossed by Lugalbanda on his journey from Erech to Aratta are different from the seven mountains crossed by Gilgamesh on his journey from Erech to the "Land of the Living," and since these seven mountains are located, as the text explicitly states, in Anshan, south of Elam,[33] the "Land of the Living" (or as it is also described in our poem, "the land of the ..cedar"), i. e. probably Dilmun, is to be sought in the same general direction.

So much for the Sumerian Elysium; the data analyzed in the preceding pages make it highly likely that the dwelling place of the immortalized flood-hero, Ziusudra, is probably to be identified with the "Land of the Living" where Gilgamesh hoped to find everlasting life, and that it is probably to be sought in southwestern Persia, with its western boundary extending along the eastern shore of the Persian Gulf from somewhere south of Elam in the direction of the Strait of Ormuz.[34] Let us now turn to the Babylonian Epic of Gilgamesh. Here, too, we find an Elysium, a special place whither the immortalized flood-hero Utanapishtim, the Babylonian Ziusudra, was translated. Unfortunately this Babylonian Elysium is left unnamed. Nevertheless, to judge from the fact that Sumerian lore constituted the basic source material for Babylonian

[29] Cf. *JAOS* 64. 14.

[30] Cf. *PAPS* 85. 321.

[31] Cf. *OECT* I pl. 7 iii 10-11, and note that the third line in our passage which is omitted in the *OECT* text is found in the unpublished duplicate UM 29-16-140. Note, too, that the final -ta of *OECT* I pl. 7 iii 10 is a scribal error (cf. *BASOR* 88. 16, note 19); the correct -šè is found in the unpublished duplicate.

[32] As already stated in note 17, Aratta is therefore to be sought *east* of Sumer, in a country adjacent to Anšan (i. e. probably Dilmun), and not, as has been inferred from the doubtful line *KAV* 183. 12, *west* of Sumer (cf. *JAOS* 45. 206 ff.).

[33] For the location of Anšan, cf. note 17. The seven mountains crossed by Lugalbanda and Gilgameš may well be the *šadê šaplûti* which Sargon boasts of having crossed (and probably) before reaching Dilmun; cf. King, *Chronicles* II 92-3.

[34] To a certain extent, therefore, Dilmun may be identified with modern Laristan, and Sir Aurel Stein in the course of his Persian explorations described in *Archeological Reconnaissances*, chapters vii and viii, may well have been treading over much that was Dilmun soil.

mythology, and especially since the two flood stories, the Sumerian and the Babylonian, parallel each other rather closely,[35] it would not be unreasonable to assume *a priori* that the Babylonian "Abode of the Blessed" is probably to be identified with Dilmun, and to be sought east and south of Babylonia. Moreover, while it is true that the Babylonian Elysium is left unnamed in the Epic of Gilgamesh, the latter provides us with a clue to its location by describing it as *ina rûqi ina pî nârâti*, "in the distance at the mouth of the rivers." Now the phrase *ina rûqi* is particularly applicable to Dilmun and especially to its hinterland, which may have been vast and in large part unknown to the Sumerians, since even in a *historical* inscription it is actually described as a land "whose place is afar off."[36] So, too, Mt. Sâbum, which like Dilmun probably bordered on Anshan and was hardly further removed from Babylonia than Dilmun,[37] is described in the first line of the Lugalbanda epic as *ašar rûqi*, "the distant land."[38] As for the phrase *ina pî nârâti*, there is no reason to assume that its topographical implications, obscure as these are for the moment, cannot refer to Dilmun, especially if we bear in mind that the Sumerian equivalent for *pî nârâti*, is probably ka-íd-da^{ki},[39] and that the former is therefore not to be confused, as it has been by practically all scholars,[40] with the *pî nârâti kilallê* of the incantations, whose Sumerian equivalent is íd-ka-min-na and which refers to the portion of the Persian Gulf where the Tigris and Euphrates rivers empty their waters.[41] In brief, on present evidence, we have good

[35] Cf. *JAOS* 64. 15 ff. It is true, as I stress there repeatedly, that the Babylonians did not hesitate to modify their Sumerian sources and to mold them in accordance with their own temper and heritage. In this particular case, however, i. e. in the case of the flood story and the immortalization of Ziusudra-Utanapištim, there is no apparent reason for assuming so drastic a change as that involving the location of the land to which the flood hero was translated.

[36] Cf. Luckenbill, *Ancient Records* II 572; the Accadian is *..maš ù dilmun^{ki} ša ašaršun rûqu*.

[37] Cf. *BE* XXXI 3 rev. 6 (for corrections, see *JAOS* 60. 237) which reads: iš-za-bu^{ki} gaba-ḫur(!)-sag(!)-gá-ta zag-an-ša(!)-an-[na-še], "Sâbu, from the 'breast' of Ḫursag [to] the 'side' [of] Anšan." It is not impossible that this Ḫursag, situated in the vicinity of Sâbu, somewhere in southwestern Persia, is the same as that mentioned in the statement describing the activities of Meskiagšer, the first ruler of the Eanna dynasty, which reads: ab-ba ba-an-tu ḫur-sag-šè ba-e$_{11}$, "(Meskiagšer) entered the sea (i. e. the Persian Gulf) and ascended (after crossing the sea) Ḫursag"; cf. *AS* 11. 86, and note 114. Perhaps, too, this is the Ḫursag which, according to the Sumerian poets, Ninurta constructed and blessed with all kinds of products (cf. *SM* 81 f.).

[38] The position of Sâbu (and of Širiḫum which also bordered on Anšan, cf. *JAOS* 45. 198 f.) in reference to Dilmun, remains obscure.

[39] Cf. *SLT* v 216.

[40] Jensen, *Das Gilgamesch-Epos* I 33, note 3; Poebel, *PBS* IV 1. 62; Albright, *AJSL* 35. 161 ff.

[41] The grammatical analysis of íd-ka-min-na = *pî-nârâti-kilallê* "the mouth of the two rivers" (cf. *AJSL* 35. 163 ff. for the texts involved) is by no means too clear. If for instance we did not have the Semitic rendering, it would have been most readily analyzed as íd-ka-min-a(k) "the river(s) of two mouths." It is also possible to treat íd-ka as a complex analogous to an-úr = išid šamê, or uru-šà = *kirib âli* (cf. Poebel, *ZA* 37. 248), i. e. as a complex which in Sumerian is appositional in character, but is best rendered in Accadian (as well as in English) as an inverted genitive construction. The meaning would then be, however, "the two river-mouths (for the longer LAL-a form of the numeral, cf. *GSG* § 294), but this rendering, too, fails to agree with the Semitic translation *pî nârâti kilallê*.

reason to conclude that Dilmun was probably not only the Sumerian "Land of the Living," but the Babylonian as well, and that the latter, therefore, is not to be sought in the far west, in Spain, which, unlikely as it may seem, has been the more generally accepted opinion among scholars,[42] but rather in the east, in southwestern Iran.[43]

However, regardless of the grammatical analysis of id-ka-min-na = *pî nârâti kilallê*, there is little doubt that the phrase refers to the Tigris and Euphrates rivers where these emptied into the Persian Gulf. The thesis that it is intended to designate the real sources of the Tigris and Euphrates in the mountains of Armenia (cf. *AJSL* 35. 161 ff.) is hardly justified; the misunderstanding results in large part from identifying the Sumerian concept of the "mouth" of a river with its *real* source, as we understand it, rather than with its source as conceived by the Sumerian poets. For it is important to bear in mind that to the Sumerian poets and priests, the *real* sources of the Tigris and Euphrates in the mountains of Armenia were of little significance. They did not understand, as we do, that the volume of the waters of the two rivers depended upon "feeding" from their tributaries, or that it was the melting winter snows which produced the annual overflow, or that the Tigris and Euphrates "emptied" their swollen waters into the Persian Gulf. Indeed their view was just the opposite; it was the Persian Gulf which was responsible for the waters of the Tigris and Euphrates and for their all-important overflow. Mythologically expressed, it was Enki who filled the Tigris and Euphrates with sparkling water (cf. *SM* 61), and who, by riding the sea, makes its waters and those of the Tigris and Euphrates, turbulent and violent, and thus produces the ḫé-gál, the overflow which brought abundance and prosperity to Sumer (cf. for the present *SM* 62 f.). In short, as the Sumerians saw it, it was not the rivers that "fed" the sea, it was not the Tigris and Euphrates that "fed" the Persian Gulf, but rather the sea that "fed" the rivers. Thus the Sumerian "mouth" of the rivers, while it coincides geographically with the actual mouth of the rivers as we understand it today, is nevertheless not to be understood in terms of our modern usage, as the place where the rivers "empty" their waters (*into* the Persian Gulf) but rather as the place where they "drink" the waters (*from* the Persian Gulf). In the light of this conception, the "mouth" of the Tigris and Euphrates may well be designated as their source, but not the real source, i. e. in the mountains of Armenia, but the source as conceived by the Sumerians, the place where they join the Persian Gulf.

While, therefore, there is little doubt that *pî nârâti kilallê* (Sumerian id-ka-min-na) of the incantation texts has reference to the Persian Gulf in the vicinity of Eridu where the Tigris and Euphrates emptied their waters, the designation *pî nârâti* in the Epic of Gilgameš, whose Sumerian equivalent is perhaps ka-id-da^{ki}, remains obscure. Nor does our available Sumerian material shed any light on it; in the extant portion of our poem "Gilgameš and Ḫuwawa," no mention is made of the crossing of a sea such as the *pî nârâti* would seem to imply. We must bear in mind, however, that thus far we have recovered only the first part of the poem, whose contents culminate in the struggle between Gilgameš and Ḫuwawa. It is not impossible that later portions of the poem which, no doubt, depict his actual quest for immortality and perhaps his meeting with Ziusudra, may make reference to some topographic notion current among the Sumerians in respect to Dilmun, which does correspond to the *pî nârâti* of the Epic of Gilgameš.

[42] Cf. *AJSL* 35. 161 f. Nor is it necessary any longer to assume that the phrase *ina rûqi ina pî nârâti* is a result of a combination of two distinct versions relating to Utanapištim's dwelling place (cf. *PBS* IV 1. 62 f.).

[43] Cf. Gilgameš's own description of his journey as probably *urḫam rîqêtam waṣ šamši* (Thompson, *EG* 54) which points to the same conclusion.

SOME METROLOGICAL PROBLEMS IN OLD-BABYLONIAN MATHEMATICAL TEXTS[1]

A. J. Sachs

Miscellaneous Prefatory Remarks

Bibliography. Neugebauer, MKT constitutes a complete collection (with photographs, copies, transcriptions, translations, mathematical commentaries, and glossary) of all the Babylonian mathematical texts available in 1937. Transcriptions and translations of a large part of this material can be found in Thureau-Dangin, TMB. A considerable number of hitherto unpublished texts are included in MCT, the manuscript of which has been ready for many months (and which is to appear as a joint publication of the American Schools of Oriental Research). O. Neugebauer, *Vorlesungen über Geschichte der antiken mathematischen Wissenschaften, I. Vorgriechische Mathematik* (Berlin, J. Springer, 1934) can be recommended as an excellent introduction to the subject of Babylonian and Egyptian mathematics.

Notation for Sexagesimal Numbers. Following Neugebauer, I use the comma to separate the sexagesimal places, the semicolon to separate integers from fractions. Thus, 3, 14, 12; 6, 40 is the equivalent of

$$(3 \cdot 60^2) + (14 \cdot 60) + 12 + 6/60 + 40/60^2.$$

In transcriptions, only the comma, never the semicolon, is used.

Transcription. With Neugebauer, I simply give the Sumerograms (so-called ideograms) without translating them into Babylonian; for example, I transcribe sag, not *pūtum*.

Metrological Relations. This article assumes knowledge of only the following Old-Babylonian relations:

Length: 30 šu-si ("fingers") = 1 kùš ("cubit") [about ½ meter]
12 kùš = 1 GAR.

Area: (The basic relation between measures of area and measures of length is: 1 area-SAR = 1 GAR².)
3, 0 še = 1 gín
1, 0 gín = 1 SAR.

Volume: (The basic relation between measures of length, area, and volume is: 1 volume-SAR = 1 area-SAR · 1 kùš
= 1 GAR² · 1 kùš.)

[1] The following abbreviations are used: BM = British Museum.—JAOS = *Journal of the American Oriental Society.*—MCT = O. Neugebauer and A. Sachs, *Mathematical Cuneiform Texts* (to be published in 1945).—MKT = O. Neugebauer, *Mathematische Keilschrift-Texte* (= QS, Abt. A, 3. Bd.), 3 vols. (Berlin, J. Springer, 1935-37).—OLZ = *Orientalistische Literaturzeitung.*—QS = *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik.*—RA = *Revue d'Assyriologie et d'archéologie orientale.*—TMB = F. Thureau-Dangin, *Textes mathématiques babyloniens* (= *Publications de la Société Orientale Ex Oriente Lux*, Tome Ier) (Leiden, Brill, 1938).—YBC = Yale Babylonian Collection.

	3, 0 še	= 1 gín
	1, 0 gín	= 1 SAR.
Capacity:	10 sìla	= 1 bán
	6 bán	= 1 PI
	5 PI	= 1 gur.

For other units in each of these categories, see the introductions to MKT, TMB, or MCT.

I. The Old-Babylonian Measures of Capacity

One of the by-products of the intensive study of Babylonian mathematical texts in recent years is the improved understanding of many aspects of Old-Babylonian [2] metrology. In this connection, perhaps the most widely applicable result is in the case of the measures of capacity, which are particularly important for a proper appreciation of the predominantly agricultural economic life of Babylonia in this period.

By the adroit combination of several problems in mathematical texts, Neugebauer [3] concluded that the Old-Babylonian mathematicians accepted as standard the following relation between the capacity measure sìla (Babylonian *qa*) and the volume measure SAR:

$$1 \text{ sìla} \approx 0;0,0,12 \text{ SAR}$$

or, conversely,

$$1 \text{ SAR} \approx 5,0,0 \text{ sìla} = 1,0 \text{ gur.}$$

Thureau-Dangin [4] subsequently pointed out that the same relation operates in still another problem of an Old-Babylonian mathematical text.[5] An unpublished mathematical text in the Yale Babylonian Collection [6] also shows the use of the same relation. In modern terms, this means that 1 sila corresponds approximately to 1 liter.[7]

There remain, however, two problems from all the extant mathematical texts—Nos. 6 and 10 in BM 85196—which have defied all efforts to bring them in line with this now well attested relation.[8] Of these two problems, BM 85196 No. 10 can be completely eliminated from the picture,[9]

[2] The overwhelming majority of the Babylonian mathematical texts fall into this period, approximately 1900 to 1600 B. C.

[3] MKT III, p. 54. The relevant problems are the following: (1) BM 85194, No. 22; (2) BM 85194, No. 24; (3) YBC 4669, Nos. 1 to 8.

[4] RA 34 (1937), p. 82.

[5] BM 85194, No. 30. A different analysis of the details of this problem—without disturbing the validity of the relation in question—is given in MCT, Chapter III, § 7, in the commentary to Problem-text O. The interpretation recently proposed by A. Segrè, JAOS 64 (1944), p. 80 (last paragraph in the left-hand column) is based on the use of metrological relations which did not obtain in the Old-Babylonian period.

[6] To be published in MCT, Chapter III, § 7, as Problem-text O.

[7] This is based on a cubit measuring approximately half a meter. Thureau-Dangin, RA 34 (1937), p. 86, computes with a cubit of 0.495 meter and reaches the value 0.97 liter as the modern equivalent of the sìla.

[8] Cf. Thureau-Dangin, RA 34 (1937), p. 86 and RA 32 (1935), p. 15. In TMB, p. 43, note 3, Thureau-Dangin finally suggested that the text of No. 10 was not in order.

[9] Although I cannot give a satisfactory explanation of No. 6 in BM 85196, I am convinced that Thureau-Dangin's interpretation points in the wrong direction.

since it can be demonstrated that it has nothing whatsoever to do with measures of capacity.

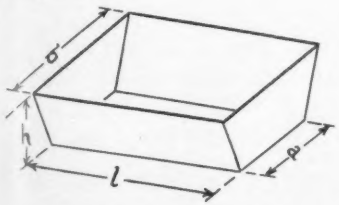
BM 85196 was first published with transcription, translation, and commentary by Thureau-Dangin, RA 32 (1935), pp. 1-28; photographs of the text were given on Plates I and II (after p. 4), and a copy prepared by Sidney Smith was reproduced on pp. 2f. A transcription, translation, and mathematical commentary were then published by O. Neugebauer, MKT II (1935), pp. 43-59. The latest transcription and translation will be found in Thureau-Dangin, TMB (1938), pp. 39-46. Problem No. 10 (obverse II, 17-22) reads as follows:[10]

17 giš*sú-sú-lum* 3, 20 kùš ugu 2, 30 za-zum ⅔ kùš bùr
18 saḫar-ḫá en-nam za-e 3, 20 *ù* 2, 30 UL-gar 5, 50 *ta-mar*
19 ½ 5, 50 *ḫe-pé* 2, 55 *ta-mar a-na* 5 uš *i-ši*
20 14, 35 *ta-mar* igi-6-gál 13½ še *ù* igi-4-gál 14[, 35]
21 *a-na* 40 sukud *i-ši* 9, 43, 20 *ta-mar* 29 še [*ù* igi-6-gál]
22 *ki-a-am ne-pé-šum*

Translation:

17 A trough,[11] 0; 3, 20 kùš[12] the top, 0; 2, 30 the bottom, ⅔ kùš the depth.
18 What is the volume? As for you—add 0; 3, 20 and 0; 2, 30. You will see 0; 5, 50.
19 Halve 0; 5, 50. You will see 0; 2, 55. Multiply by 0; 5, the length.
20 You will see 0; 0, 14, 35, (*namely,*) *one-sixth, 13 1/2 še and one-fourth.* 0; 0, 14[, 35]
21 mutiply by 0; 40, the height. You will see 0; 0, 9, 43, 20, (*namely,*) *29 še* [*and one-sixth*].
22 Such is the procedure.

In the interpretation of the dimensions of the trough, I follow Thureau-Dangin:[13]



$b = 0; 3, 20$ GAR $= ⅔$ kùš

$a = 0; 2, 30$ GAR $= ½$ kùš

$h = ⅔$ kùš

$l = 0; 5$ GAR $= 1$ kùš,

where l, although not given in the statement of the problem, must be

[10] For Thureau-Dangin's divergent readings and interpretation, see RA 32 (1935), pp. 14 f. and TMB, p. 43.

[11] For this meaning for the *sussulum* made of wood, see the latest discussion of the word by G. Meier, OLZ 43 (1940), 306. The shape and the size given for this object in our mathematical problem are in accord with this interpretation.

[12] Thureau-Dangin is certainly right in interpreting 3, 20 kùš to mean 0; 3, 20 GAR, the equivalent of ⅔ kùš.

[13] RA 32 (1935), p. 14. The figure and notation follow Neugebauer, MKT II, p. 43.

inferred from the subsequent calculations. The mathematical skeleton of the problem is clearly visible if one ignores, for the moment, the words and numbers italicized in the translation. This skeleton is very simple: the volume v of the trough is calculated step by step according to the Babylonian formula for a truncated pyramid:

$$v = \frac{b + a}{2} \cdot l \cdot h.$$

Applied to our problem, this means specifically

$$v = \frac{0;3,20 \text{ GAR} + 0;2,30 \text{ GAR}}{2} \cdot 0;5 \text{ GAR} \cdot \tfrac{2}{3} \text{ kùš}$$
$$= 0;0,14,35 \text{ area-SAR} \cdot \tfrac{2}{3} \text{ kùš}$$
$$= 0;0,9,43,20 \text{ volume-SAR}.$$

The first phrase printed in italics in the translation represents nothing more than the correct reduction in standard fashion of 0; 0, 14, 35 area-SAR to the proper lower units of the area-gín and the area-še. In other words, 0; 0, 14, 35 area-SAR is expressed as "one-sixth (of an area-gín [14]), 13½ area-še, and one-fourth (of an area-še)." That this breakdown is correct can be seen from

⅙	gín	= 0; 0, 10 area-SAR
13½	še	= 0; 0, 4, 30
¼	še	= 0; 0, 0, 5
Total:		0; 0, 14, 35 area-SAR

The reading 13 in 13½ še instead of 12 (so Thureau-Dangin; Smith's copy) is based on an examination of the half-tone reproduction of the photograph given by Thureau-Dangin.[15]

The second phrase given in italics in the translation is similarly nothing more than the corresponding reduction of 0; 0, 9, 43, 20 volume-SAR to the lower units of the volume-še; and, in fact,

$$0;0,9,43,20 \text{ volume-SAR} = 29\tfrac{1}{6} \text{ volume-še}.$$

Compared with Thureau-Dangin's analysis,[16] this interpretation of the problem eliminates (1) the emendation of igi-4-gál, in line 20, to igi-6-gál; (2) one of the two mathematical problems offered in evidence for an alleged Old-Babylonian bán of 12 sìla instead of 10 sìla; (3) the use of this problem for the determination of the volume of the sìla.

The value for metrological discussions of the only relation which is solidly attested in Old-Babylonian mathematical texts[17] between measures of capacity and measures of volume,

[14] The word gín, as often in similar cases, is omitted.

[15] RA 32 (1935), Plate I (after p. 4).

[16] See note 10. The interpretation suggested by A. Segrè, JAOS 64 (1944), p. 80 (second and third paragraphs in the left-hand column) cannot be considered seriously because it assumes metrological relations for which there is not the slightest evidence from texts of the Old-Babylonian period.

[17] See above, p. 30 and notes 3 to 5.

1 sìla ≈ 0; 0, 0, 12 SAR (i. e., approximately 1 liter),

has recently been attacked by H. Lewy [18] in the following words: [19]

At first sight, it appears tempting to make use for the calculation of the measures of capacity of the various stereometrical school texts with their seemingly precise data. However, it must not be forgotten that those texts served the purpose of familiarizing the student with stereometry, on the one hand, and with the qualities of the numbers and their handling in the sexagesimal system, on the other. Therefore the problems were chosen so as to contain, in most cases, numbers divisible by each other without a rest, or square roots of square numbers, cube roots of cube numbers, and the like. Accordingly, the measures of capacity occurring in the operations had to be adapted to the nature of the problem, a procedure which could be used without danger since, as may be stressed again, the purpose of the texts was not to acquaint the student with the measures of capacity the knowledge of which was presupposed.— If I skip the schoolbook which I used as a child when studying the elements of mathematics, I find there the same adaptation of measures to the nature of the problem: for the sake of reckoning with simple relations, the American pound is figured at 460 grammes instead of 453.59; the yard is rounded off to $1\frac{1}{12}$ of a meter instead of being exactly 91.44 centimeters, and so on.

Brushing aside with these words the relation between the measures of capacity and the measures of volume used in the Old-Babylonian mathematical texts, Mrs. Lewy finally reaches the conclusion that the sìla corresponds to 1.34 liters from Neo-Sumerian times on. A critical appraisal of the arguments by which Mrs. Lewy reaches this value would lead us too far afield. I must, however, confess that I fail to see how her value for the sìla can be correct for the Old-Babylonian period in view of what the contemporaneous mathematical texts tell us about the measures of capacity. In the two examples which Mrs. Lewy cites from her own elementary textbook, the convenience of the rounded-off values for the pound and yard is not gained by sacrificing the order of magnitude. In the one case, the rounded-off value deviates from the correct value by about $1\frac{1}{2}\%$; in the other, by about $\frac{1}{4}$ of 1%. But the exact value for the sìla (1.34 liters) posited by Mrs. Lewy is more than 30% greater than the value which can be deduced from the Old-Babylonian mathematical texts (about 1 liter). The relative convenience or inconvenience of the numbers cannot be blamed for this considerable discrepancy, since, if the Old-Babylonian sìla really had the value proposed by Mrs. Lewy, a basic relation something like

1 sìla ≈ 0; 0, 0, 16 SAR or 1 sìla ≈ 0; 0, 0, 15 SAR

should certainly be expected in the mathematical texts of the period.

II. The Size of a gi-sa

The following is a discussion of four Old-Babylonian mathematical problems, for which new interpretations are offered.[20] New results are reached concerning the size of a gi-sa assumed in these problems.

[18] "Assyro-Babylonian and Israelite Measures of Capacity and Rates of Seeding," JAOS 64 (1944), pp. 65-73.

[19] JAOS 64 (1944), p. 65, note 5.

[20] In none of the four cases do I make an attempt to present or systematically criticize the details of the previous interpretations, which are referred to in the notes accompanying the discussion of each problem.

The volume of a gi-sa is given by BM 85196,[21] No. 5 (obverse I 24-28), which reads as follows:

24 giš-má-lá 1 GAR uš ½ 2 kùš sag 6 sukud gi-sa-ḫá en-nam
25 za-e 1 uš *a-na* 40 sag *i-ši* 40 *ta-mar* 40 *a-na* 6 sukud
26 *i-ši* 4 *ta-mar* gar-ra nigín-na igi 5 saḫar-ḫá 1 gi-sa-ḫá
27 du_8-a 12 *ta-mar* 12 *a-na* 4 *i-ši* 48 *ta-mar* 4 (geš'u) 8 gi-sa-ḫá
28 *ki-a-am ne-pé-šum*

Translation:

24 A cargo boat, 1 GAR the length, ½ (GAR and) 2 kùš the width, 6 the height. How many gi-sa (can it hold)?
25 As for you—multiply 1, the length, by 0; 40, the width. You will see 0; 40. Multiply 0; 40 by 6, the height.
26-27 You will see 4. Put (it) down. (Now) turn about: take the reciprocal of 0; 0, 5, the volume of 1 gi-sa.[22]
27 You will see 12, 0. Multiply 12, 0 by 4. You will see 48, 0. (This means:) 4 geš'u and 8, 0 gi-sa.
28 Such is the procedure.

The length l, the width w, and the height h of the space in which the gi-sa are to be loaded are given as:

$$l = 1 \text{ GAR} \quad w = ½ \text{ (GAR) } 2 \text{ kùš} = 0;40 \text{ GAR} \quad h = 6 \text{ (kùš)}.$$

The volume v of the cargo boat is then calculated by the formula for rectangular prisms:

$$v = lwh = 1 \cdot 0;40 \cdot 6 = 4 \text{ volume-SAR}.$$

From this point on, my choice of the order of magnitude differs from that of Thureau-Dangin because instead of "4 (geš'u) 8" in line 27, he read "48," which, according to him,[23] "paraît avoir été écrit sur le signe *ḪA*." Aside from the fact that it is difficult to see any motivation for the ḪA in the first place, the halftone reproduction of the photograph as well as the copy made by Smith[24] show 4 (geš'u) 8: .

Since 4 geš'u = 4 · 10, 0 = 40,0, the following 8 must be interpreted as 8, 0, thus giving a total of 48, 0 for the number of gi-sa which could be loaded on the cargo boat. Accordingly, the volume of one gi-sa would amount to only 0; 0, 5 volume-SAR, not Thureau-Dangin's 0; 5 volume-SAR. This is confirmed by a consideration of the other three problems involving gi-sa.

Problem No. 2 (obverse I 8-12) of the same mathematical text, BM 85196, reads as follows:

[21] For the bibliographical details of this text, see above, p. 31.
[22] The text gives the plural here.
[23] RA 32 (1935), p. 9, note 3; so also Neugebauer, MKT II, p. 43, note 3.
[24] The photograph is reproduced RA 32 (1935), Plate I (after p. 4); Smith's copy is given on p. 2 of the same article.

8 gi-sa 4 gúr ki-ta 2 šu-si gúr an-na 6 sukud saḫar-ḫá en-nam
9 za-e 4 KIL-KIL 16 *ta-mar* 16 *a-na* 5 igi-gub *i-ši-ma*
10 1, 20 *ta-mar* 2 KIL-KIL 4 *ta-mar* 4 *a-na* 5 *i-ši* 20 *ta-mar*
11 1, 20 *ù* 20 UL-gar-ma 1, 40 *ta-mar* ½ 1, 40 *ḫe-pé* 50 *ta-mar*
12 50 *a-na* 6 sukud *i-ši* 5 *ta-mar* saḫar-ḫá *ne-pé-šum*

Translation:

8 A gi-sa, 0; 4 the lower circumference, 0; 2 šu-si [25] the upper circumference, 6 the height. What is the volume?
9 As for you—square 0; 4. You will see 0; 0, 16. Multiply 0; 0, 16 by 0; 5, the fixed reciprocal,[26] and
10 you will see 0; 0, 1, 20. Square 0; 2. You will see 0; 0, 4. Multiply 0; 0, 4 by 0; 5.[26] You will see 0; 0, 0, 20.
11 Add 0; 0, 1, 20 and 0; 0, 0, 20, and you will see 0; 0, 1, 40. Halve 0; 0, 1, 40. You will see 0; 0, 0, 50.
12 Multiply 0; 0, 0, 50 by 6, the height. You will see 0; 0, 5, the volume. (Such is) the procedure.

As was pointed out by the previous interpreters, the figure in question is a truncated cone. My analysis differs in regard to the order of magnitude assigned by the text to the circumference c_1 of the lower circle, the circumference c_2 of the upper circle, and the height h:

$$c_1 = 0;4 \text{ GAR} \qquad c_2 = 0;2 \text{ GAR} \qquad h = 6 \text{ kùš}.$$

Once the areas a_1 and a_2 of the lower and upper circles are computed by [26]

$$a_1 = c_1^2 \cdot 0;5 \qquad a_2 = c_2^2 \cdot 0;5,$$

the text proceeds to calculate the volume v of a gi-sa by

$$v = \frac{a_1 + a_2}{2} \cdot h = 0;0,5 \text{ volume-SAR}.$$

We thus reach precisely the same value for the volume of a gi-sa which was inferred from No. 5 of BM 85196.

Another problem which again leads to exactly the same result for the volume of a gi-sa is BM 85194,[27] No. 14 (obverse III 23-30), which reads as follows:

23 gi-sa 4 gúr ki-ta 1 [28] gúr an-na 6 sukud
24 saḫar-ḫá en-nam *ù* dal saḫar-ḫá an-na *ù* saḫar-ḫá
25 ki-ta [29] za-e 4 KIL-KIL 16 *ta-mar* 16 *a-na*
26 5 gúr *i-ši* 1, 20 *ta-mar* 2 KIL-KIL 4 *ta-mar*
27 4 *a-na* 5 gúr *i-ši* 20 *ta-mar* 1, 20 *ù* 20 UL-gar

[25] Just as 3, 20 kùš means 0; 3, 20 GAR = ⅔ kùš (see note 12), 2 šu-si here means 0; 2 GAR = 12 šu-si.
[26] The factor 0; 5 = 1/12 is to be interpreted as $1/4\pi$, where π is approximated as 3. The area of a circle is therefore given by the product of the square of the circumference and 0; 5.
[27] Neugebauer, MKT I, pp. 142 ff., where the previous literature is cited; Thureau-Dangin, TMB, pp. 21 ff.
[28] Mistake for 2.
[29] The final vertical wedge of -ta is mistakenly omitted in the text.

28 1, 40 *ta-mar* ½ 1, 40 *ḫe-pé* 50 *ta-mar* 50 *a-na* 6 sukud
29 *i-ši* 5 *ta-mar* saḫar-ḫá gi-sa-ḫá
30 *ki-a-am ne-pé-šum*

Translation:

23 A gi-sa, 0; 4 the lower circumference, 0; 2[30] the upper circumference, 6 the height.
24-26 What is the volume, and (what are) the diameter, the upper volume, and the lower volume? As for you—square 0; 4. You will see 0; 0, 16. Multiply 0; 0, 16 by 0; 5, of the circumference. You will see 0; 0, 1, 20. Square 0; 2. You will see 0; 0, 4.
27 Multiply 0; 0, 4 by 0; 5, of the circumference. You will see 0; 0, 0, 20. Add 0; 0, 1, 20 and 0; 0, 0, 20.
28-29 You will see 0; 0, 1, 40. Halve 0; 0, 1, 40. You will see 0; 0, 0, 50. Multiply 0; 0, 0, 50 by 6, the height. You will see 0; 0, 5. (This is) the volume of a gi-sa.[31]
30 Such is the procedure.

Except for the second part of the question[32] and insignificant variants in the phraseology, this problem is a duplicate of the one which has just been discussed (BM 85196, No. 2).

The fourth problem which mentions gi-sa is rather obscure. BM 85194,[27] No. 15 (obverse III 31-37), which directly follows the problem discussed in the previous paragraph, reads as follows:

31 gi-sa 4 za-zum 2 mu-ḫu 6 sukud 5 sa[ḫar-ḫ]á
32 3 kùš *e-li* dal *ù* saḫar-ḫá en-nam za[-e]
33 4 za-zum ugu 2 mu-ḫu en-nam *i-ter*
34 2 dirig igi 6 sukud du_8-a 10 *ta-mar* 10 [*a-na* 2 *i-*]*ši*
35 20 *ta-mar* 20 *a-na* 3 *ša te-lu-ú i-ši*
36 1 *ta-mar* 1 *i-na* 4 za-zum ba-z[i 3 *ta-mar*]
37 3 dal *ki-a-am ne-pé-šum*

Translation:

31 A gi-sa, 0; 4 (the circumference of) the base, 0; 2 (the circumference of) the top, 6 the height, 0; 0, 5 the vo[lum]e;
32 I ascended 3 kùš. What are the diameter and the volume? As for you—
33 by what did 0; 4, (the circumference of) the base, exceed 0; 2, (the circumference of) the top?
34 It exceeded by 0; 2. Take the reciprocal of 6, the height. You will see 0; 10. Multiply 0; 10 [by 0; 2].
35 You will see 0; 0, 20. Multiply 0; 0, 20 by 3, which you ascended.
36 You will see 0; 1. Subtract 0; 1 from 0; 4, (the circumference of) the base. [You will see 0; 3.]
37 The diameter is 0; 3. Such is the procedure.

[30] The text gives 0; 1 by mistake.
[31] The text gives the plural here.
[32] In translating the second part of the question, which is apparently not answered in the text, I tentatively follow Thureau-Dangin. I am not sure just what it means

In the statement of the problem, we again find precisely the same dimensions (though the terminology is disconcertingly abbreviated) given for a gi-sa as in the last two problems discussed just previously. The first half of the question which is asked [33] concerns the "diameter" of the gi-sa at a height h' of 3 kùš, i. e., half way up. If we employ the same notation as in the case of BM 85196, No. 2, the dimension which is finally calculated and called "diameter" is

$$c_1 - \frac{c_1 - c_2}{h} \cdot h'$$

which would correspond to the circumference, not the diameter, at a height h' of 3 kùš. However this apparent contradiction is to be explained, there is certainly no reason to assume dimensions for the gi-sa itself different from those in the two problems discussed just previously.

Thus, the connection between the four mathematical problems mentioning gi-sa is established by the fact that the same dimensions hold in all the problems. One of the consequences is that it is no longer necessary to assume a purely geometrical meaning, "truncated cone," in addition to the meaning "bundle of reeds" which has been suggested for gi-sa in non-mathematical contexts. The shape and dimensions of a standard bundle of reeds are interesting in themselves: a truncated cone, 6 kùš (about 3 meters) long, the circular base having a circumference of 24 šu-si (about .4 meter) and a diameter of about 8 šu-si, and the circular top with a circumference of 12 šu-si (about .2 meter) and a diameter about 4 šu-si. The length of a bundle of reeds, 6 kùš, lends significance to the height of 6 kùš assumed for the cargo boat mentioned in the first problem.[34]

III. Bricks

An unpublished Old-Babylonian mathematical text [35] in the Yale Babylonian Collection formed the starting point for a more general investigation of the metrological system used for the counting of bricks to the end of the Old-Babylonian period.[36] It turns out that not only are the names of the units the same as those used in the system of measures of area or volume, but the relations between the individual units are also the same. Whereas the basic unit in the system of area or volume measures is the SAR, which is defined by

$$1 \text{ area-SAR} = 1 \text{ GAR}^2 \qquad 1 \text{ volume-SAR} = 1 \text{ GAR}^2 \cdot 1 \text{ kùš},$$

the SAR used in counting bricks can be defined as

$$1 \text{ brick-SAR} = 12,0 \ (= 720) \text{ bricks}$$

without regard for the dimensions of the individual bricks which were to be counted. The identity of the relations between the individual

[33] The second part is apparently not answered. To add to the confusion, the volume of the gi-sa is actually given in the statement of the question, but is not used thereafter.

[34] See above, at the beginning of this section.

[35] The text will be published in MCT, Chapter III, § 7, as Problem-text O.

[36] For details, see the commentary to Problem-text O mentioned in the previous note.

measures in the area-volume system and the measures bearing the same names in the brick system can be seen by the following:

Area or Volume	Bricks
1 gín = 0; 1 SAR	1 gín = 0; 1 SAR = 12 bricks
1 SAR = 1 SAR	1 SAR = 1 SAR = 12, 0 bricks
1 ubu = 50 SAR	1 ubu = 50 SAR = 10, 0, 0 bricks
1 iku = 1, 40 SAR	1 iku = 1, 40 SAR = 20, 0, 0 bricks
1 ešè = 10, 0 SAR	1 ešè = 10, 0 SAR = 2, 0, 0, 0 bricks
1 bùr = 30, 0 SAR	1 bùr = 30, 0 SAR = 6, 0, 0, 0 bricks
etc.	etc.

By the use of these relations and the dimensions for five types of brick given in the unpublished Yale text mentioned at the beginning, it was found possible in MCT to explain satisfactorily a number of published and unpublished mathematical and economic texts dealing with bricks. One problem in a published Old-Babylonian mathematical text, the solution of which was discovered too late for convenient insertion in MCT, is YBC 4669, No. 13 (obverse III 9-12), which reads as follows:[37]

9 1 (bùr)[38] iku sig_4
10 2 GAR sukud-bi
11 gagar[39] en-nam
12 10⅓ S[AR 5 g]ín[40]

Translation:

9 1 bùr of bricks,
10 2 GAR their height.
11 What is the area?
12 10⅓ S[AR (and) 5 g]ín.

This problem is typical of a large group of mathematical problems which merely state the question and the solution but do not give the calculations by which the answer is reached. In spite of the laconic form in which it is presented, this problem can be related to others (discussed in MCT) involving the stacking of bricks in a heap having the shape of a rectangular prism. From the metrological information given in the question and the answer, one can infer that the bricks involved are of the type which has been called "type 1" in MCT. The dimensions of the "type 1" brick are:

length l = ½ kùš = 0; 2, 30 GAR
width w = ⅓ kùš = 0; 1, 40 GAR
height h = 5 šu-si = 0; 10 kùš

[37] See Neugebauer, MKT III, p. 27.

[38] In MKT, this was read "1 (ešè)"; Neugebauer considered improbable the reading "10," which is the paleographical equivalent of "1 (bùr)." I think it more probable that the traces of a horizontal mark before "1 (bùr)" are either a scratch or the result of an erasure.

[39] This reading is based on a recent examination of the tablet.

[40] This reading and restoration are in good accord with what can be seen on the tablet. They also suit well the signs and traces at the beginning of the next problem (which is severely damaged), which is certainly closely related to this one.

with the resulting volume v for a single brick:

$$v = lwh = 0; 2, 30 \cdot 0; 1, 40 \cdot 0; 10 = 0; 0, 0, 41, 40 \text{ volume-SAR.}$$

This type is known from other mathematical problems, and is always called simply sig$_4$, "brick." With this information, we can clearly see the nature of the question and how it was solved.

The number N of bricks of "type 1" and the height H of the stack of bricks are given as:

$$N = 1 \text{ bùr} = 6, 0, 0, 0 \text{ bricks}$$
$$H = 2 \text{ GAR} = 24 \text{ kùš.}$$

The question which is posed concerns the area A of the horizontal cross-section of the stack. Since the volume V of the stack is

$$V = AH$$

and since V can be expressed as

$$V = Nv,$$

the solution can easily be found by

$$A = \frac{Nv}{H} = \frac{6, 0, 0, 0 \cdot 0; 0, 0, 41, 40}{24} = 10; 25 \text{ area-SAR,}$$

the transformation of which to conventional metrological units leads to 10⅓ area-SAR and 5 area-gín, which is given as the answer in the text.

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